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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXIX.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.
1915.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXIX.—PART I.

January 1915.

A. W. BORTHWICK, D.Sc.,
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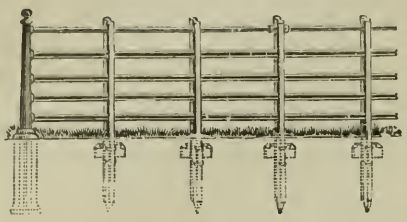

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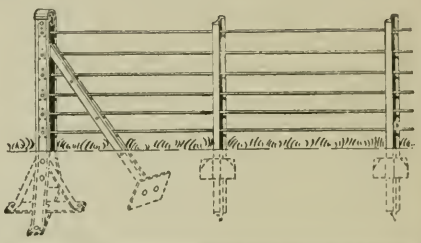

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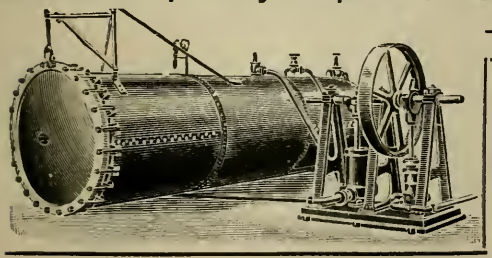

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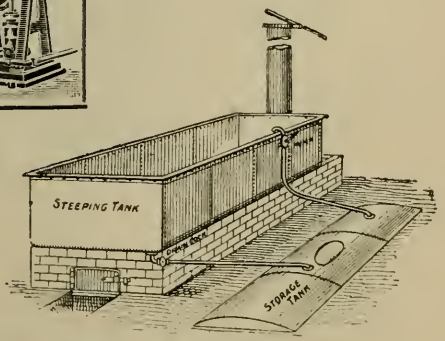

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Members are elected by the Council. The Terms of Subscription will be found on the back of the Form of Proposal for Membership which accompanies this Memorandum.

The Principal Objects of the Society,

and the nature of its work, will be gathered from the following paragraphs:—

Meetings.

The Society holds periodical Meetings for the transaction of business, the reading and discussion of Papers, the exhibition of new Inventions, specimens of Forest Products and other articles of special interest to the Members, and for the advancement of Forestry in all its branches. Meetings of the Council are held every alternate month, and at other times when business requires attention; and Committees of the Council meet frequently to arrange and carry out the work of the Society.

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In 1882 the Society strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

In 1890, the Society instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. The Society also drew up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland, which was laid before the Departmental Committee on British Forestry, and in their Report the Committee recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government, in 1907, acquired the Estate of Inverliever in Argyllshire; and while this cannot be looked on as a Demonstration Forest, it is hoped that it may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. Meantime Sir Ronald Munro Ferguson, for a part of whose woods at Raith a Working-Plan is in operation, very kindly allows Students to visit them.

After the Development Act came into operation, the Council passed a Resolution urging that the Government should create a Board of Forestry, with an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting. The Society's policy for the development of Forestry in Scotland has since been fully laid before the Development Commission. As a result of these representations, the Secretary for Scotland appointed a Committee to report regarding the acquisition and uses of a Demonstration Forest Area, and any further steps it is desirable to take in order to promote Silviculture in Scotland. The Committee reported in the beginning of 1913, and the Society is pressing the Board of Agriculture for Scotland, being the Department now concerned with Scottish forestry, to give effect to the Committee's recommendations and to encourage the inception of schemes of afforestation. The Society has also published a valuable Report on Afforestation—including a Survey of Glen Mor—prepared for it by Lord Lovat and Captain Stirling, which, it is hoped, may form the basis of the general Forest Survey advocated by the Society.

Resolutions in favour of the acquisition of part of Ballogie, on Deeside, and Supplementary Areas in other districts for Demonstration purposes, and of the creation of a Department of Forestry for Scotland with a separate annual grant, were passed at last Annual Meeting.

In connection with the celebration of the Society's Diamond Jubilee last summer, representative Foresters appointed by the Governments of Denmark, France, Holland, Hungary, Russia, Sweden, India, Canada, New Zealand, and South Africa visited this country as guests of the Society. Accompanied by a number of home representatives they made a Tour of Inspection, extending to about a fortnight, of woods and afforestable lands in Scotland, and at the Conference held in Edinburgh before leaving, they expressed the joint opinion that Scotland lends itself admirably to afforestation on a large scale, and that national support should be given to the movement. A copy of the Report of the proceedings containing their Resolution, and also the Society's Resolution adopting it, has been sent to Ministers and Government Departments, and to all Members of Parliament for Scottish constituencies.

Excursions.

Since 1878 well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, Ireland, and the Continent. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, in 1904 the Forest School at Nancy and Forests in the north of France were visited, in 1909 a visit was undertaken to the Bavarian Forests, and during the summer of 1913 ten days were spent in the Forests of Switzerland. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, and Prizes and Medals are offered for Special Exhibits. In addition to this Annual Exhibition, large and important Forestry Sections organised by this Society were included in the Scottish National Exhibition held in Edinburgh in 1908, and in the Scottish Exhibition of National History, Art, and Industry, held in Glasgow in 1911.

Plantations and Estate Nurseries Competitions.

Prizes are now offered annually for the best Young Plantations and the best managed Estate Nurseries within the Show District of the Highland and Agricultural Society.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-eight volumes, are published half-yearly in January and July, and are issued *gratis* to Members.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the Honorary Officials mentioned above.

Local Branches.

Local Branches have been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

Consulting Foresters.

The Secretary keeps a list of Consulting Foresters whose services are available to Members of the Society and others.

Correspondents.

The following have agreed to act as Correspondents residing abroad :—

Canada, . Robert Bell, I.S.O., M.D., LL.D., D.Sc.(Cantab.), F.R.S. of Ottawa, late Chief Geologist to Government of Canada, Ottawa.

India, . . F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.

British East Africa, . Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, Hugh P. Baker, Dean, New York State College of Forestry, Syracuse, N.Y.

Cape Colony, . W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.

New Zealand . R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago.

South Africa . K. A. Carlson, Orange Free State Conservancy.

LOCAL SECRETARIES.

Scotland.

Counties.

Aberdeen, . John Clark, Forester, Haddo House, Aberdeen.
John Michie, M.V.O., Factor, Balmoral, Ballater.

Argyll, . . H. L. Macdonald of Dunach, Oban.

Ayr, . . Andrew D. Page, Overseer, Culzean Home Farm, Ayr.
A. B. Robertson, Forester, The Dean, Kilmarnock.

Berwick, . Wm. Milne, Foulden Newton, Berwick-on-Tweed.

Counties.	
	Scotland.
Bute,	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, retired Forester, Barone, Rothesay.
Clackmannan,	Robert Forbes, Estate Office, Kennet, Alloa.
Dumfries,	D. Crabbe, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. Curr, Factor, Ninewar, Prestonkirk.
Fife,	Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.
	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	James A. Gossip, Nurseryman, Inverness.
Kincardine,	John Hart, Estates Office, Cowie, Stonehaven.
Kinross,	James Terris, Factor, Dullomuir, Blairadam.
Lanark,	John Davidson, Forester, Dalzell, Motherwell.
	James Whitton, Superintendent of Parks, City Chambers, Glasgow.
Moray,	D. Scott, Forester, Darnaway Castle, Forres.
Perth,	John Scrimgeour, Doune Lodge, Doune.
Ross,	Miss Amy Frances Yule, Tarradale House, Muir of Ord.
Roxburgh,	John Leishman, Manager, Cavers Estate, Hawick.
	R. V. Mather, Nurseryman, Kelso.
Sutherland,	Donald Robertson, Forester, Dunrobin, Golspie.
Wigtown,	James Hogarth, Forester, Culhorn, Stranraer.
	H. H. Walker, Monreith Estate Office, Whauphill.
	England.
Beds,	Francis Mitchell, Forester, Woburn.
Berks,	W. Storie, Whitway House, Newbury.
Derby,	S. MacBean, Estate Office, Needwood Forest, Sudbury.
Devon,	James Barrie, Forester, Stevenstone Estate, Torrington.
Durham,	John F. Annand, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	Thomas Smith, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. Cowper, Gortanore, Sittingbourne.
Lancashire,	D. C. Hamilton, Forester, Knowsley, Prescot.
Leicester,	James Martin, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. Havelock, The Nurseries, Brocklesby Park.
Notts,	W. Michie, Forester, Welbeck, Worksop.
	Wilson Tomlinson, Forester, Clumber Park, Worksop.
Surrey,	John Alexander, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. Christie, Hillside, Castle Road, Warley, Birmingham.
Wilts,	Andrew Boa, Land Agent, Glenmore, The Avenue, Trowbridge.
York,	George Hannah, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin,	A. C. Forbes, Department of Forestry, Board of Agriculture.
	Arch. E. Moeran, Lissadell, Stillorgan Park.
King's County,	Wm. Henderson, Forester, Clonad Cottage, Tullamore.
Tipperary,	Alex. M'Rae, Forester, Dundrum.

Royal Scottish Arboricultural Society.

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes :—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums :—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. The Home Pitwood Supply.

By J. H. Milne Home.

The present war has brought home to the population of these islands, in a manner never before realised, the extent of our dependence upon foreign supplies for innumerable articles of necessity. This condition of affairs is fairly obvious as regards foodstuffs, and has received much attention in recent years in newspapers and books.

It may, however, be safely asserted that few persons outside the trades directly concerned, had any idea that the collieries of England, Wales and Scotland were almost wholly dependent upon foreign supplies of pitwood for carrying on their operations and producing coal for domestic and industrial purposes.

It has been stated on reliable authority that the annual consumption of pitwood in Scottish coal-mines is about 280,000,000 lineal feet, and that its value is equal to 6d. per ton of coal produced. This pitwood is mainly in the round, and varies from 2 inches diameter at the small end up to about 6 inches. There is also great variation in the length of the pieces. Generally speaking "short" pitwood may measure from 2 ft. 9 ins. to 6 feet, and "long" pitwood 10 feet to 14 feet. The size which seems to be in most general use is 3 inches diameter at the small end. Sizes vary largely in different districts and different pits—an important consideration being the thickness of the seams of coal being worked. The following figures refer to the consumption of pitwood in a group of Lanarkshire pits, and may be taken as fairly typical:—

Size of Pitwood.	Per Cent. Lineal Feet.
$2\frac{1}{2}$ inches	12
3 "	59
$3\frac{1}{2}$ "	14
4 "	5
$4\frac{1}{2}$ "	2
5 "	8
	100

The average diameter will thus be about $3\frac{1}{2}$ inches to 4 inches, representing say 22,000,000 or 23,000,000 cubic feet of pitwood timber annually consumed by the collieries of Scotland.

The foreign supply is estimated to represent about 90 per cent. of the total consumption. A fairly large amount of pitwood is exported from Bordeaux, and a smaller quantity from Portugal. Practically the whole of these supplies are absorbed by the South Wales coal-fields. The main sources of pitwood production for the coal-mines of the Midlands, the North of England, and Scotland are found in the Baltic, more especially in Finland and Russia. This pitwood is almost wholly peeled Scots pine. The Baltic ports from which this pitwood is exported are nearly all liable to be closed by ice in winter. In consequence the whole year's export is usually overtaken between May and October.

The outbreak of war early in August thus placed the coal-owners in a serious position. Only a portion of the year's supply of pitwood had been delivered, and owing to the closing of the Baltic it was obviously impossible that, even under the most favourable circumstances, further supplies could come to hand before June 1915. Meanwhile the stocks in Scotland were not estimated to last longer than the end of the current year.

The Forestry Branch of the Board of Agriculture for Scotland showed itself fully alive to the urgency of the matter, and convened a preliminary conference on 27th August 1914. A second conference was held about one week later, and this resulted in the appointment of two Committees to investigate (1) supplies of suitable timber and labour, and (2) specification and prices. These Committees went fully into the whole question, and obtained a large amount of information upon the pitwood trade. The incidence of the railway rates upon pitwood prices was seen to have such an important bearing, that the matter was brought to the attention of the Secretary for Scotland and the President of the Board of Trade. Mr Runciman consented to receive a deputation of those interested, and the interview took place at the Board of Trade on 22nd October 1914. An official report regarding the various meetings may possibly be issued, and it is not proposed now to refer further to what has passed at these meetings. The Royal Scottish Arboricultural Society, the Landowners' Co-operative Forestry Society, The Home Timber Merchants' Association of Scotland, and the Coal-Owners' Association of Scotland were all represented at the various meetings held.

A very considerable difference of opinion appears to exist as to (1) the number of cubic feet or lineal feet of pitwood per ton, and (2) the number of lineal feet of pitwood per cubic foot.

In neither case is exact calculation possible, seeing that the sizes given always refer to the diameter of the piece at the small end. The cubical contents of the piece will vary according to the form-factor or taper of the prop. Moreover, the *average* diameter of a prop, say 3 inches at the small end and 3 feet in length, will naturally be less than the average diameter of a 3-inch prop of 5 feet in length. It is estimated that for 2 inches and $2\frac{1}{2}$ inches pitwood, a 20 per cent. allowance should be made on the quarter-girth at the small end, a 15 per cent. allowance for 3 inches, and a 10 per cent. allowance above that size.

With regard to the number of cubic feet to a ton, there is room for very wide variation according to the species of timber, and its condition at the moment—whether it is newly felled containing a large amount of water, or has been peeled and dried for some months. It is possible to calculate with fair accuracy the minimum and maximum of cubic feet per ton, but it must be clearly kept in view that in actual practice various intermediate quantities may be got. Figures quoted from actual weighings and measurements, while no doubt perfectly accurate for the particular consignment, cannot necessarily be accepted as conclusive for average results.

A cubic foot of water weighs $62\frac{1}{2}$ lbs., and assuming for the purpose of calculation that timber has the same weight, an addition of say 15 per cent. must be allowed for bark which is not measurable. A further allowance must be made between solid measurement and quarter-girth measurement, represented by the proportion 77·9 : 100·0. This gives 92·2 lbs. per cubic foot, quarter-girth measurement, for a specific gravity of 1·0, and assuming freshly felled coniferous timber to have a S.G. of ·9, the actual weight per cubic foot, quarter-girth, would be 83 lbs. or 27 cubic feet per ton. In the case of peeled timber no bark allowance is necessary, and assuming a S.G. of ·6 for fairly well dried pitwood, the weight per cubic foot, quarter-girth, would be 48 lbs., or 46 cubic feet per ton.

On the basis of these calculations the following table has been prepared. The other figures given are merely a matter of arithmetic.

Table giving Particulars regarding Short Pitwood of 2 feet to 6 feet length, average sav 3 ft. 6 ins.

Diameter at Small End	Equivalent Quarter-Girth	Estimated Average Quarter-Girth of Piece	Average Sectional Area	Lineal Feet per Cubic Foot	Cubic Feet per 100 Lineal Feet	Estimated Cubic Feet per Ton		Estimated Lineal Feet per Ton		Prices Free on Rail at Colliery Sidings			
												Per Ton	
						Peeled and Dried	Unpeeled	Peeled and Dried	Unpeeled	Per 100 Lineal Feet	Per Cubic Foot	Peeled and Dried	Unpeeled
Inches	Inches	Inches	Square Inches							s. d.	s. d.	s. d.	s. d.
2	1·57	1·9	3·61	40·0	2·50	46	27	1840	1080	3 6	1 4·8	64 4	37 9
2½	2·00	2·4	5·76	25·0	4·00	46	27	1150	675	5 0	1 3·0	57 6	33 9
3	2·36	2·8	7·84	18·4	5·42	46	27	846	497	6 0	1 1·3	51 0	30 0
3½	2·75	3·0	9·00	16·0	6·25	46	27	736	432	7 0	1 1·3	51 0	30 0
4	3·14	3·5	11·90	12·1	8·26	46	27	556	326	8 3	1 0	46 0	27 0
4½	3·53	3·9	15·21	9·5	10·52	46	27	437	256	10 6	1 0	46 0	27 0
5	3·93	4·3	18·49	7·1	14·08	46	27	326	191	14 0	1 0	46 0	27 0
6	4·71	5·2	27·04	5·3	18·80	46	27	244	143	19 0	1 0	46 0	27 0

The prices given must not be taken as representing a standard market rate. They are, however, approximately the values current at the present time (November 1914), and show a substantial advance on the prices ruling before the outbreak of war.

An examination of the table will show at once the enormous difference in weight between freshly felled and unpeeled wood, and peeled and dried wood. This difference is a vital consideration in railway carriage, and is also of great importance for cartage. For thoroughly dry wood the railway carriage for comparatively long distances, although burdensome, is not necessarily prohibitive. For wet unpeeled wood the railway rate over the same distance may easily be prohibitive. Unfortunately, in the present emergency much pitwood must be conveyed in a wet state if the Scottish collieries are to be kept going. It may be a matter for argument who is to pay for the weight of water so carried, but there would certainly seem to be strong grounds for asking the Government, as an emergency measure, to reduce the railway rates to such a degree as would counterbalance the additional deadweight existing in undried pitwood.

Assuming that there is no alteration in railway rates, the result is likely to be an excessive felling of young woods within a 50 miles radius of the colliery districts; a consequence much to be deplored in the interests of Scottish forestry. Another probable result will be the holding back of supplies for some months until the timber is well dried, and the railway carriage less onerous in consequence. Meanwhile the coal-owners have signified their willingness to take unpeeled wood of any species except beech, and to accept it whether freshly felled or seasoned. It may in many cases be a convenience to cut heavier stems than 5 inches diameter to produce pitwood. It was, therefore, necessary to adjust the equivalents in quartered or squared props. These equivalents are :—

Round Props. Diameter		Quartered Log of Diameter of		Square Prop of
2 inches	equal to	$4\frac{1}{2}$ inches	or	2 inches × 2 inches.
$2\frac{1}{2}$,,	,,	$5\frac{1}{2}$,,	,,	$2\frac{1}{2}$,, × $2\frac{1}{2}$,,
3 ,,	,,	$6\frac{1}{2}$,,	,,	$2\frac{3}{4}$,, × $2\frac{3}{4}$,,
$3\frac{1}{2}$,,	,,	$7\frac{1}{2}$,,	,,	$3\frac{1}{8}$,, × $3\frac{1}{8}$,,
4 ,,	,,	$8\frac{1}{2}$,,	,,	$3\frac{3}{8}$,, × $3\frac{3}{8}$,,
$4\frac{1}{2}$,,	,,	$9\frac{1}{2}$,,	,,	$3\frac{5}{8}$,, × $3\frac{5}{8}$,,

It has been announced that the Board of Trade have been making inquiries regarding pitwood supplies from other sources. A certain number of shiploads have been secured from Norway and the White Sea, but these cannot form anything like an adequate supply. Inquiries have also been made in Canada and Newfoundland, and no doubt large quantities of pitwood could be got from these sources. The prices quoted are, however, fairly high, and it is doubtful whether any extensive import will take place unless at an average price of about 40s. per ton, c.i.f.

While the immediate supply of pitwood for English and Scottish collieries during the period of the war is, no doubt, a matter of great national urgency, the opportunity seems favourable to consider the possibility of a large permanent increase in the output of home pitwood. It is not possible to estimate with any exactitude what percentage of the total pitwood consumption of Scotland could be regularly met from home forests. A moderate estimate would seem to be 25 per cent. to 30 per cent. of the total requirements, or say 70,000,000 to 85,000,000 lineal feet, equal to about 3,000,000 cubic feet.

The question of railway rates has been already referred to, and is a vital matter where long distances are involved. Probably two-thirds of the forests of Scotland producing pitwood lie at a distance of 80 to 170 miles from the point of consumption. It is not to be expected that any permanent wholesale reduction of rates is possible. Railway companies require to earn profits for their shareholders like other trading companies. It does seem possible, however, in the case of lines running into the North of Scotland that by means of better organisation, regularity of supply, and co-operation between the railway companies and producers, a substantial reduction in rates could be made without loss to the railways. Actual cases have been quoted where the railway rate for pitwood is 50 per cent. higher than that for coal, although some dry pitwood can be loaded on a truck to within 20 per cent. of the weight of coal. It must be evident to any one travelling in the Highlands that the number of full waggons going north, mainly with coal, is in marked contrast with the number of empty waggons coming south. It has been stated that coal waggons are not suitable for conveying pitwood, but this is manifestly incorrect seeing that the

imported foreign pitwood is almost invariably brought back to the collieries in coal trucks. If, therefore, all the coal waggons going into the Highlands returned loaded with pitwood, the additional cost to the railway company would be much less than if special trucks were sent for the timber traffic, as appears to be the present custom. The present rates to the Inverness area, which is fairly typical, represent about 1d. per ton per mile, or say 12s. 6d. per ton. The cost of felling, peeling, sawing and cartage will, naturally, vary according to the class of wood and the distance from the railway siding. It is unlikely under the most favourable conditions to be less than 3d. per cubic foot, and may in many cases be as much as 6d. per cubic foot. In the table given on page 4 it is estimated that completely dried pitwood might, under favourable conditions, measure 46 cubic feet to the ton. This is perhaps too high a figure to take as an average, which may be stated at 42 cubic feet per ton. Taking the manufacture and loading at 4d. per cubic foot gives a cost free on rail of 14s. per ton, and adding the railway rate of 12s. 6d. would show an outlay at the colliery sidings of 26s. 6d. per ton of 42 cubic feet, or 7·6d. per cubic foot. This leaves out of account the price of the standing timber, and the profit to the merchant.

It must be assumed that prices will, after the war, fall to about the level hitherto experienced. These prices may be stated at from 9d. to 10d. per cubic foot, or 31s. 6d. to 35s. per ton of 42 cubic feet. These prices, applied to the example of the Inverness area above referred to, only show a surplus of from 5s. to 8s. 6d. per ton, or 1·4d. to 2·5d. per cubic foot for the price of the standing timber and the merchant's profit. This is much too slender a margin to develop any regular trade. Could, however, the railway companies see their way to reduce rates by 25 per cent., provided empty coal trucks were used and a regular supply of several thousand tons of pitwood guaranteed, the margin of profit would be increased by fully 3s. per ton, or upwards of 1d. per cubic foot. It must be admitted that a price of even 3d. per cubic foot for standing pitwood timber is not a highly attractive one, but it at least offers the possibility of a market for a class of timber which is not at present readily saleable in large quantities. It must also be kept in view that under normal conditions pitwood timber merely represents the thinnings and cleanings of middle-aged spruce and Scots pine woods, and that

looked at from this aspect a price of 3d. per cubic foot standing is quite worthy of consideration. The returns for woods within 50 or 60 miles of collieries would of course be much more favourable.

Only in a regular and systematic output is to be found the secret of production at the lowest possible cost, and it is just in this direction that Scottish forestry has—with certain notable exceptions—been deficient in the past. In the endeavour to find markets for small or inferior forestry produce, a careful and accurate record of the cost of production is an absolute necessity, and any initial profit, however small, is worth taking, with the object of developing, through experience, a more lucrative trade, and conferring a national advantage in the employment of additional labour in country districts.

2. Wood Charcoal—Its Manufacture and Use.[1]

By W. D. Ashton Bost.

[The following paper although written for the purpose of correcting wrong ideas as regards the use of charcoal for insulating purposes, is nevertheless of considerable interest to foresters, as it touches upon many points concerning an almost unknown industry in this country, namely, the manufacture of wood charcoal and other products obtainable from the dry distillation of wood. It is very generally admitted that if sufficient raw material of the proper kind was available in this country, new industries would spring up, among which it is probable that those concerned with wood-derivatives would not be the least important. At the same time, certain facts must be brought to light by careful preliminary investigation before a definite opinion can be expressed regarding the possible future prosperity of an economic undertaking, but surely in this case the object should be worth some little trouble. In a recent letter, Mr Bost says: "I would particularly emphasise the fact that in considering the advisability of starting wood distillation a little knowledge is a most dangerous thing, and that it cannot pay unless everything is known, down to the smallest detail, which might affect either the gathering of the wood or the marketing

[1] A paper read before the Institute of Marine Engineers, Feb. 2, 1914.

of the products, and that except under very exceptional circumstances it will not pay in this country to start new works."

This does not preclude the possibility of increasing the present output by already existing works and incidentally of increasing the consumption of home-grown wood, and who knows to what future developments this might not lead.—HON. ED. *Trans.*]

Nobody who has worked with wood fires can have failed to notice that under the ashes, if the fire goes out, will be found charcoal. The ashes form a coating sufficiently impervious to the air to allow the charred wood to cool without access of air. The advantages of charcoal for culinary purposes would be so obvious that the reduction of wood to charcoal in an analogous way, but with less loss of wood, must have appealed to primeval man at an early point in his life, after the discovery of fire. As charcoal contains more heat-producing material than wood, its use became imperative when the extraction of metals from their ores was attempted, and when making the charcoal in big masses condensation of part of the gases was bound to take place on the portion farthest removed from the source of heat, and tar would run out from the bottom of the heap. The antiseptic properties of this tar, and especially that obtained from carbonising the cedar, were early recognised, and it was largely used in embalming processes. Tar produced in this way from coniferous woods, known as archangel tar, is still used in the preparation of ropes as a preservative.

We therefore have a natural sequence of events from an intelligently observed fact down to a certain point, but there is a lapse of many centuries to the point where the composition of the tar was examined into, and nearly two centuries elapsed before advantage was taken of the results of this examination. It was only in 1858 that Glauber demonstrated that the acid contained in the distillate from wood had the same composition as vinegar, and only in the beginning of the nineteenth century was it discovered that methyl alcohol and acetone were also constituents of the acid liquid.

Another discovery relating to the utilisation of gases produced in the carbonisation of wood was made by Phillipe Lebon, in 1767, namely, that they, or rather a part of them, could be utilised as an illuminant. He started works under a contract from the French Government to supply the tar produced to the Navy as part of the process, but could not make a commercial

success of the other part of the process owing to the immense amount of lime he had to use in order to free the gases of acid products, including the carbonic acid. Pettenkoffer was able to greatly improve the illuminating power of the wood gas by superheating it, but the introduction of coal gas with its much greater illuminating power at less cost killed any chance of going on with this industry. The industry had, however, got a start, and investigation was pushing forward. According to Klar, a works for wood distillation was started in 1819, at Hausach (Baden), but it did not pay. Later on the discoveries in connection with the manufacture of aniline colours called for products and derivatives of wood distillation such as pure methyl and acetone, and it was only then that the wood distillation business may be said to have been born, in so far as the manufacture and recovery of all its products is concerned.

Outside of the recovery and utilisation of all the products it is evident that there has always been a demand for charcoal, originally for heating purposes, such as cooking and metal smelting, but with the invention or introduction of gunpowder a new demand sprang up. The charcoal for this purpose should be easily ignited, burn quickly, and leave little ash, and the more cellulose a wood contains the more suitable for gunpowder will be the charcoal. Dogwood and alder are the woods preferred for sporting powder, while for blasting powder birch can be employed. For making certain powders it is preferable that the distillation be not carried to complete carbonisation, but that some of the gases be left in the wood which is then brown instead of black, and is called "Charbon Roux."

Very exacting regulations were at one time inserted into powder contracts so as to secure uniformity in the analysis and properties of the charcoal employed in its manufacture. The manufacture of charcoal for gunpowder, owing to the use of smokeless powder, has of late fallen off very considerably, and the demand for charcoal for this purpose is consequently now insignificant compared to what it was at one time.

Another use to which charcoal has been put for many years is in the foundry, where it is used in the form of a wash for painting the moulding sand so as to form a skin between the molten metal and the sand. In preparing charcoal blacking for this purpose the nature of the wood again plays an important part, oak producing the best; but as for some castings blacking made

from gas coke can be used, it is evident that for certain classes of work almost anything is suitable.

I am indebted to Messrs Turnbull & Co., of Glasgow, the oldest manufacturers in Scotland of moulders' blacking, for the following particulars:—

"Wood blacking is made from oak or beech wood charcoal, and is specially prepared before it is milled to the finest powder, suitable for the foundry. It is used principally on green-sand castings for baths, columns, and all light ornamental work. The aim of the founder is to get the smoothest skin possible, and of a bluish nature, which rightly or wrongly many of the practical founders assert they can only get from oak or beech wood charcoal blacking. For loam and dry-sand castings a mixture is made with oak wood and a mineral carbon, which, after preparation, is milled also to the finest grade and is used as a blackwash on all marine and other heavy castings, such as ingots, cylinders, sole plates, etc., etc.

"The blackings used in this class of work have to show a very high percentage of carbon to resist the metal eating into the sand. These blackings are sold under the names of imperial or patent blackings, and have a large sale at home and abroad. A further use in the foundry for wood blacking is a grade milled like meal, which is used as a burning blacking, and also along with bone charcoal is utilised as an annealing agent."

The greatest demand for charcoal used to be for the manufacture of charcoal iron, but in this country the demand has fallen off very greatly since the introduction of steel, which is so much cheaper.

Mr George Turner, 300 Langside Road, Glasgow, has written a most interesting pamphlet on "Ancient forestry and the extinct industries of Argyllshire and part of the adjacent counties," from which I cull the following most interesting information:—

"From the twelfth century onwards Scotland, on account of its woods, produced charcoal iron. In many cases bog iron was used, but traces have been found where shallow pits were mined to get the hematite. It was found cheaper to carry ore to the charcoal than charcoal to the ores. Each furnace devoured the wood annually from 120 acres of land, so that the furnaces were constantly being shifted to follow the wood. As a consequence there have been found in the West of Scotland no fewer than 2000 slag heaps, but many of these bear evidence that once

the timber had grown up again in the locality the furnaces came back and the slag heap was again utilised. At first the furnaces were built in valleys open to the prevailing wind, thus getting a natural blast, but when bellows were discovered many went to water-courses where they could utilise the water power while also being near the wood. The small furnace originally used produced small blooms, which were slightly spongy but malleable. Later on, as furnaces got bigger, the iron became more of the nature of cast-iron till now it is entirely in that form."

The journal of the Royal Society of Arts contains an article by Mr Henry B. Wheatly, D.C.L., F.S.A. (vol. lxi., Sept. 19th and 26th, 1913), which gives some very interesting information *re* charcoal iron works in England, but overlooks those of Messrs Harrison Ainslie as being still in existence. In reviewing the course of iron works prior to the use of coal or coke, he alludes to the danger to the country by denudation of forests, which threatened to become so acute that the Navy Commissioners about 1660 nominated John Evelyn to investigate the subject. Mr Wheatly quotes a very interesting paragraph from Evelyn's report :—

"Nature has thought fit to produce this wasting ore more plentifully in woodlands than any other point, and to enrich our forests to their own destruction—a deep execration of iron mills and iron masters also."

It was in Scotland that Messrs Harrison Ainslie started their Lorn Works at Bonawe in Lorn (Argyllshire) in 1753, removing them later to the Lindal Moor mines near Ulverston, and I am indebted to them for the following information :—

"We are still manufacturing charcoal pig-iron, our brand being known as 'Lorn,' and we consume upwards of 3000/4000 tons of lump charcoal per annum, which we require in the manufacture of this special iron. At one time charcoal iron was extensively made in this country, but owing to the increasing cost of charcoal and to the scarcity of it, different furnaces have gone out of blast, and have been dismantled, and now the furnace owned by this company and situated at Backbarrow, on the river Leven, is the only charcoal furnace working in Great Britain. This furnace was erected in the early part of the eighteenth century, and with the exception of heightening the original furnace to increase its capacity the process of manufacture is identical with that used at that time. The furnace

produces about eight tons per day of cold blast 'Lorn' charcoal pig-iron. This iron is expensive to manufacture, and is the dearest on the market, but in spite of the cost of manufacture it has a ready sale, and is despatched to all corners of the world. It goes to Australia, New Zealand, Japan, China, Europe, and is very largely used in the United States, where it is mixed with other irons to make malleable castings.

"Charcoal iron is made very extensively in Sweden and in Russia. The Swedish particularly is sold in Great Britain, and competes to a certain extent with the 'Lorn' charcoal pig-iron; but for special manufacture the 'Lorn' iron, though it is more expensive, holds its own, as it has peculiar properties which the Swedish and Russian charcoal irons do not possess. This is accounted for by the different class of iron ore used to make 'Lorn' iron as against Swedish and Russian iron. The ore used for the manufacture of 'Lorn' iron is specially selected from the hematite mines situated at Lindal Moor in the Furness district, and the secret of the specially peculiar properties of the 'Lorn' iron is the use of special ore which can only be had from these mines. For many years the manufacture of the 'Lorn' brand of charcoal pig-iron was intermittent, and a great deal of the market was lost at the time owing to the irregular manufacture of same, the various users of our 'Lorn' iron being unable to depend on receiving their requirements. This was due to short supplies of charcoal. At that time the furnace was entirely dependent on charcoal produced in Great Britain, the chief source of supply being what was termed country charcoal, viz.: charcoal burnt in kilns in the coppices in the immediate neighbourhood of the furnace. For a radius of thirty and more miles from the furnace it has been the practice of landowners to grow coppice wood specially for the manufacture of charcoal, for which there was always a ready sale to the Backbarrow furnace, and coppice wood is still grown throughout the English lake district, in which the furnace is situated, for this purpose; but as time went on fewer coppices were grown, so that there came a time when the local supplies were insufficient for the requirements of the furnace, and to augment it chemical charcoal was bought, and all surplus chemical charcoal on the British market was sold to the Backbarrow furnace. Even this was not sufficient to keep the furnace going for more than four to six months per year. There being an increasing demand for

the 'Lorn' brand of iron other sources of charcoal had to be found, and we are now importing charcoal very largely from the Continent, it being found that the best chemical charcoal could be delivered at our furnace from abroad at prices equal to and even less than the chemical charcoal manufacturers in this country insisted that they required to make their business pay. To make our iron, wood charcoal is absolutely essential, just as much so as the special ore used, but the writer is strongly of opinion that there is no room for the increased manufacture of charcoal pig-iron in this country. We have plenty of ore, but as already pointed out there is an insufficiency of charcoal, and further there is a limited demand for the iron owing to its high cost. Swedes make and export ordinary charcoal pig-iron in very large quantities, and they can afford, owing to their being able to procure cheap charcoal, to undersell any iron which could be manufactured in this country; and if it were not that we manufacture a charcoal pig-iron which they cannot copy, owing to their being unable to secure the ore, the Back-barrow furnace would not pay to work."

In America the output of charcoal iron is enormous owing to the vast amount of cheap wood and the furnaces carbonising it for themselves and recovering the products. Many works also are situated in the natural gas belt which enables their fuel costs, always a serious item, to be cut down to the lowest point. A large outlet for charcoal iron, even after steel had been long introduced, was in the tinplate trade in Wales, but it has had to give way there also to steel under the stress of competition though it has still its uses there.

I have tried in the foregoing to give some idea of the rise of the manufacture of wood charcoal from small beginnings to its present immense proportion consuming thousands of tons of trees per day, and its position in this country to-day. Charcoal in any shape or size may be used for gunpowder or blacking, but it requires to be in good-sized lumps for burning purposes, and this requirement has led to the necessity for finding an outlet for the smalls and dust caused by the breaking down of the charcoal in the retorts and in transit. Such an outlet has been found in charcoal briquettes, such as are now extensively used in Dalli irons and carbotron stoves. Owing to the method of manufacture the charcoal is generally re-carbonised, and at a higher heat, and is therefore slower burning, and, if

well made, quite inodorous. It is perhaps needless to say that, in burning, it gives off carbonic acid gas like most other combustibles.

We now come to a class of wood charcoal, namely, flake charcoal, differing in the shape of the raw material used, and the totally different plant necessitated by its form, which plant in its turn materially affects the conditions under which it is produced. As a matter of fact, the weight of acid from any wood, whether in the log or in shavings (the raw material for flake charcoal), is the same for equal moisture, but shavings produced in the manufacture of spools for thread are made from very dry wood, distil quickly, and allow of very high temperatures being used in order to get a large daily output per unit plant. This high temperature, however, has an effect on the charcoal, which is much lighter than that produced from logs, but the yield in charcoal is much less, being about 33 per cent. of the weight of the logs (after deducting moisture) and under 20 per cent. of the weight of the shavings. The charcoal produced from the shavings is thus more difficult to ignite than that made from the logs, and is also much lighter per cubic foot. It is this latter quality which makes it so valuable (along with its shape) for insulation.

A word or two now about the manufacture of charcoal. Originally, and following the experience of charcoal made as the result of a fire of wood, wood was piled in a heap in the open. It was then set on fire and covered up with earth, mud or clay, which cracked in all directions, under the influence of heat and the pressure of the gases. The gases oozed out through the cracks thus formed in great quantities up to a certain point, and then gradually fell off, till when the wood was completely carbonised they stopped almost completely. The cracks were then carefully plastered over and the heap left to cool. A variation on this process was subsequently made by digging a trench in which the wood was placed, thus diminishing the surface which had to be plastered. Both these methods are still in use all over the world in spite of their great antiquity. I was lately in the English lake district, and was taken high up into the hills, where I saw men at work making the heaps, firing some and smothering others. As the entrance of air during the cooling process would mean a loss of charcoal through burning, and as the charcoal burners are only paid

according to the charcoal they produce, the heap requires constant attention day and night, and in all weathers.

It is under totally different conditions that wood must be carbonised if the gaseous products have to be recovered, and for this purpose plant which will let no gas escape to the air is necessary. Originally, the plan was to replace the mud and clay by bricks and mortar, but this was soon found to be impracticable, both as regards saving the gas and preventing the access of air during the cooling process. There are still some of these in use, principally for the manufacture of archangel tar, the price of which is such that, coupled with cheap wood and cheap labour, the losses can be ignored. The bulk of the wood is now carbonised in cast or malleable iron cylinders, the size of which varies from 3 ft. dia. to 8 ft. Each size has its devotees and advantages and disadvantages, from the point of view of time for each operation, yield of products and cost of handling.

[The suitability of charcoal for insulating purposes is dealt with in the remainder of the paper, which includes many valuable tables of interesting statistics.]

3. Dupplin Castle Estates, Perthshire.

By W. Dawson.

The Dupplin Castle Estates, the property of Sir John A. Dewar, Bart., contain an area of about 2240 acres of woodlands in addition to about 120 acres of park or policy woods. The woods had for long been neglected, and it is only three years ago that a beginning was made with the present scheme of management. The bulk of the woods had been planted between 1780 and 1820, on ground which was once probably moorland with marshy patches in parts. Some of the areas had been agricultural land, though these areas had only formed a very small part of the whole. Little planting had taken place, from the end of the period mentioned till the present scheme began, although there had been considerable activity in the way of removing more or less ripe timber, by bare clearing some areas and by over-thinning the rest. The consequence is that the age-classes are now not well balanced. There is too big an area of old timber in the form of understocked woods; there is a large area unstocked; and the areas

of young and middle-aged wood is too small. In 1913 there was:—

Unstocked area			699 acres.
Age, 1 to 20 years			145 ,,
,, 21 ,, 40 ,,			153 ,,
,, 41 ,, 60 ,,			21 ,,
,, 61 ,, 80 ,,	327 acres	1309 ,,	
,, 81 ,, 100 ,,	533 ,,		
,, 100 ,, 135 ,,	449 ,,		

Of the 1309 acres of old wood over 1000 acres are now past commercial maturity, and the ground is only partially stocked.

The woods are situated at elevations of from 50 feet to 450 feet above sea-level. The soil is mostly a fair loam of various degrees of heaviness. It varies in depth, and in many places overlies stiff clay. The rainfall of the district amounts to about 30 inches per annum. The district is not unduly exposed to frost or snow. Certain of the woods are, however, exposed to considerable risk from wind. This danger has been greatly increased by injudicious fellings in the past. The most dangerous storms come from the north and north-east, and on these sides areas have been cut, thereby exposing the big extent of remaining woods.

In the scheme of management now in operation, about 1300 acres are meantime to be worked on the clean-cutting system, and the remaining area, being partly under broad-leaved trees or being in proximity to the park, are to be worked on a modified group-selection system. Although natural regeneration is extremely easy in the conditions prevailing here, the bare-clearing system is necessary meantime, partly because the open condition of the woods has permitted a dense surface vegetation to come up, and partly because it is desirable to change the species of trees. The Scots pine (*Pinus silvestris*) is meantime the predominant tree, but the conditions of soil and climate will permit of more valuable and quicker-growing species being planted. The species to be planted besides Scots pine are Douglas fir (*Pseudotsuga Douglasi*), larch (*Larix europœa*), Japanese larch (*Larix leptolepis*), Sitka spruce (*Picea sitkaensis*), and, on a limited scale, *Thuja gigantea*, *Cupressus nutkatensis*, and *Chamœcyparis Lawsoniana*. Of broad-leaved trees, oak and sycamore are the chief. The species are mostly to be grown in pure groups, but beech or other shade-bearers will be grown with larch, pine and oak.

A nursery of about 2 acres in extent was started in 1912,

and is now in condition for supplying the planting material as well as for growing rarer species for planting in the park.

The woods are all badly provided with roads, and all new plantations are to be laid out in proper compartments with a proper series of roads and paths.

In the present condition of the woods it would serve no useful object to attempt to fix the area which will ultimately be cut and replanted annually. There is every likelihood that the present clean-cutting system will be done away with, and its place taken by natural regeneration on the group-system. It has been assumed meantime that the production of about 30 to 35 acres could be cut each year. Thus the present unstocked area represents more than twenty times the normal area which should fall to be restocked each year. It is proposed to plant at the rate of about 60 acres a year for the first five years, and for the following period of seven years at the rate of 50 acres per annum, and then for two years more at the rate of 25 acres per annum. Thus the whole of the unstocked ground would be brought under crop in fourteen years. In the first five years none of the old wood is to be felled, but all the woods are to be cleaned up and dead and back-going trees removed. In the sixth year a beginning is to be made with the removal of the old woods, and for a period of seven years an area of about 10 acres per annum is to be cut. After that period the annual cut is to be increased to from 30 to 35 acres.

The planting scheme thus is:—

	Unstocked Area	Stocked Area	Total
1st to 5th Year	60 acres per annum, or total of 300 acres	No clearing. Removal of blown, back-going trees, etc.	300 acres
6th to 12th Year	50 acres per annum, or total of 350 acres	10 acres per anuum, or total of 70 acres	420 acres
13th and 14th Year	25 acres, or total of 50 acres	35 acres, or total of 70 acres	120 acres
		Total in 14 Years . .	840 acres

PLATE I.

FIG. 1. MAVISTON, BRODIE, ELGINSHIRE.
Low wood produced on flat sands by natural seeding; about 55 years of age, and containing over 4000 cubic feet of timber per acre.

FIG. 2. MAVISTON, BRODIE, ELGINSHIRE.
Natural regeneration carried out on the "strip system" on flat sands.

[*To face p.* 18.

[*Photo: Geological Survey.*

FIG. 3. MAVISTON SAND-HILLS, ELGINSHIRE.
Sand advancing and overwhelming plantation of Scots fir. The flutings at the top of the slope are due to the arrest of the sand by the tops of the buried trees.

For the utilisation of the timber the estate sawmills had been greatly improved. It is probable that a travelling sawmill will be procured when the cutting of the old wood commences. A creosoting plant has also been added, for treating timber for estate purposes.

4. The Planting of the Sand Dunes at Culbin.[1]

(*With Plates.*)

By P. Leslie, M.A., B.Sc., Marischal College, Aberdeen.

One of the most striking illustrations that we possess in this country of lands, otherwise useless, being reclaimed and made of economic value by means of afforestation, is afforded by the experiments which have been carried out during the last hundred years on the large stretches of sand known as the Maviston and Culbin Sands, situated on the Morayshire and Nairnshire coasts between the rivers Nairn and Findhorn.

In both localities, the sands can be separated into three zones. The large sand-hills on the north, often over 100 feet in height, are nearest the coast. Inland they are succeeded by medium-sized dunes, which again merge into a flat area of sand 2 to 3 feet deep. The flat sands usually cover a moss formation which, in the case of Maviston, is a continuation of the bog of Loch Loy farther to the west.

At Maviston, on the Brodie estate, the flat areas are well wooded. They contain trees of various ages, which for the most part have been produced by natural regeneration. The oldest part of these woods has been cut down, but a few well-grown specimens have been left on the ground. The age of these is between 70 and 80 years. They average over 40 feet in length, and girth 6 ft. at 4 ft. 9 ins. from the ground. To the north of them is a younger plantation, about 55 years of age (Plate I. Fig. 1). Mr Morrison, estate manager, Brodie, has kindly furnished me with particulars regarding this wood. There are, on an average, 525 trees to the acre. A few sample trees were felled. They were 32 ft. long, girthed 26 ins. at 16 ft. from the root, and contained about 9 cubic feet of timber. This would give a total cubical content of 4725 feet, representing a value of

[1] A paper read before the Aberdeen Branch of the Society, on 17th October 1914. The paper was illustrated by lantern slides.

£108, 5s. per acre. The trees seem to be suffering from insufficient moisture, and some of them are dying. As they are now putting on very little growth, they should be cut down as early as is convenient. Probably they would be in a better condition if they had been subjected to a heavy thinning when younger, but that is a difficult matter to express an opinion on, and, in any case, they compare favourably with plantations growing on similar situations on the Continent. Natural regeneration is carried out on scientific principles, usually on the strip or compartment systems. The nature of the surface seems to allow of the seeds becoming easily covered, and a very thick growth of young trees soon springs up.

There is no sharp or well-defined boundary between this low-lying and comparatively level area and the hummocky dunes into which it gradually emerges. In parts the latter also are well wooded, but those nearest to the large sand-hills are as yet covered only with a few rabbit-pruned trees, which are struggling to make headway in spite of the adverse conditions with which they have to contend.

The large sand-hills, of which there are several at Maviston, flank these dunes to the north and west. Two of them are of special interest on account of the manner in which they have destroyed, and are continuing to destroy, the plantations lying in their path (Plate II. Fig. 3). They have no bent growing on their surfaces, and are both making comparatively rapid progress. One is proceeding westwards, the other and more important eastwards. The latter is some 40 feet in height. It slopes gradually to the west, but has on the east a bold bluff side which makes an angle of about 40 degrees with the vertical. It advances on the trees with all the regularity of a well-formed embankment. After it has moved forward some distance in its course, its victims, or rather their bleached and whitened skeletons, again appear (Plate III. Fig. 4). Still farther to the rear, where the sand has almost completely left the devastated area, nature has begun to repair the damage. At first the ground becomes covered with Xerophytic grasses, and also with *Juncus squarrosus*, species of Carex, trefoil, birch and dwarf willow. A thin layer of peat is also present. Later on, a thick growth of young Scots pine trees takes complete possession, and will, in course of time, replace the wood which has been destroyed. On the Brodie estate, the whole area under

FIG. 4. MAVISTON SAND-HILLS, ELGINSHIRE. [*Photo: Geological Survey.*
Pine forest for a time overwhelmed by advancing sand, and its remains now laid bare by the further advance of the sand.

[*To face p.* 20.

[*Photo: Geological Survey.*

FIG. 5. CULBIN SAND-HILLS, ELGINSHIRE: NEAR THE BINSNESS PLANTATIONS.

The background shows a travelling dune of advancing sand. The steep bank with cornice atop and slipping sand on slope, the tails of sand behind the tufts of bent, and the wind ripples in the foreground, indicate that the sand-drift is from left to right, *i.e.*, from west to east.

Scots pine on the bog land and the flat of sand, as well as on the spaces between the sand-hills, amounts to 220 acres. The large sand-hill proceeding eastwards is about 35 acres in extent, while the area it has completely passed over amounts to 50 acres. The ages of the trees on this area range from 1 to 20 years, and give a fairly accurate idea as to the rate of progress of the hill.

Although the Maviston Sands have a grandeur of their own, they are comparatively insignificant when contrasted with the main body of sand at Culbin, three miles farther eastward. With the permission of the author, Mr Bain, Nairn, the following details regarding the appearance and tragic history of this at one time fertile but now desert region are largely borrowed from his books, the *Story of a Buried Estate*, and *The Findhorn River*, which deal with the subject.

The Culbin Sands proper cover an area 4 miles long by 2 miles broad. Towards the north they are covered with sand piled up into ranges of hills and valleys in seemingly endless succession. From the top of these hills, which often exceed 200 feet in height, an excellent view is obtained of the surrounding country, and of the far distant hills of Cromarty. In the valleys, the old land surface often comes to view. The furrows made by the plough two hundred years ago are still visible. Here and there beds of peat, shingle beaches, heaps of oyster and other shells are to be seen, while collectors find the place a happy hunting-ground for antiquarian treasures. Flint arrow-heads, scrapers, and stone axes are often discovered, and bronze pins, coins and rings have frequently been picked up. In 1898, a Roman coin of date 21 B.C. was found. The old bed of the Findhorn, which watered the alluvial meadows that at one time formed the most fertile agricultural land of Moray, can still be traced. The river ran westwards for a considerable distance on the north side of the estate.

The history of the estate is associated with that of the family of Kinnaird. About the middle of the twelfth century Freskin or Freskinus, a rich Flemish merchant who gave the King financial assistance, acquired large tracts of land in the North of Scotland. In these remote regions he and others were outposts of European civilization amid the primitive Gaels, missionaries of the feudal system which David I. sought to establish throughout his realm in place of the clan or tribal polity. The doughty Fleming, Wilkin Flammock, in Sir Walter Scott's

Betrothed, is an excellent description of this twelfth century type of half trader, half feudal baron. Freskin died in 1171, leaving the whole of Sutherland to his son Hugh, who is the first authentic ancestor of the Earls of Sutherland. His second son, William, acquired the estates of Duffus, in Morayshire. From him the Dukes of Athole are descended. Another family, the De Moravias, this being the territorial name which they assumed, were settled at Culbin at the same time that William was settled at Duffus. Records point to their being cousins or near relatives of the sons of Freskin. In 1400, Thomas Kinnaird married the heiress of the De Moravias. The estate was settled on their second son, whose descendants retained possession until their heritage was ruined by a sudden incursion of sand from the west.

"The lands of Culbin were known as the granary and garden of Moray. Stretching away in the distance in every direction were to be seen the highly cultivated fields with heavy corn, the rich meadows dotted here and there with thriving herds, and the extensive pastures with numerous flocks. One can judge of the value of the property when it is stated that, if it had come down unimpaired to our day, its rental would be at least £6000 a year.[1] The estate extended to 3600 acres. The rent-roll still exists. The Findhorn River, which rushes through so many romantic gorges in its upper course, flowed past the north side of the lands in a slow, steady stream. Along its banks were rows of fishermen's huts with their boats and fishing gear in front, all these dwellings teeming with life and activity. The late frost or the protracted drought might destroy the crops in other parts of the district, but so deep and rich was the alluvial soil of Culbin that their crops never failed. The sand which overwhelmed the estate came from the west in the autumn of 1694. It came suddenly, with short warning—a man ploughing had to desert his plough in the middle of the furrow. The reapers in a field of barley had to leave without finishing their work. In a few hours the plough and barley were buried beneath the sand. In terrible gusts the wind carried the sand amongst the dwelling-houses of the people, sparing neither the mansion-house of the laird nor the hut of the cottar. The

[1] The actual rental of Culbin about the middle of the seventeenth century, according to the County cess books, was as follows:—money rent £2720 Scots, 640 bolls of wheat, 640 bolls of bear, 640 bolls of oats, and 640 bolls of oatmeal.—GRIGOR.

splendid orchard, the beautiful lawn, all shared the same fate. In the morning after the first night of drift, the people had to break through the backs of their houses to get out. They relieved the cattle and drove them to a place of safety. A lull in the storm succeeded, and they began to think they might still have their dwelling-houses, though their lands were ruined for ever. But the storm came on with renewed violence, and they had to flee for their lives. To add to the horror of the scene, the sand had choked up the mouth of the river Findhorn which now poured its flooded waters amongst the fields and homesteads, accumulating in lakes and pools until it rose to a height by which it was able to burst the barrier to the north and to find a new outlet to the sea, in its course sweeping to destruction the old village of Findhorn."

The luckless proprietor was ruined. The estate was sold in 1698 to Duff of Drummuir, the grandson of Adam Duff, the ancestor of the Dukes of Fife. He did not retain it long. Some thirty-five years later he became involved in financial difficulties and the Culbin estate was sold on behoof of his creditors, bringing a sum of £1000. The largest part of it is now included in the estate of Moy. To the east of Moy lies the estate of Binsness, and to the south the small property of Kincorth. Between Brodie and Moy are situated the low woods of the estate of Dalvey. They have been produced by natural seeding, are about 1800 yards wide, and form with the Moy plantations a barrier between the Maviston and Culbin Sands. It looks as if the large sand-hill at Maviston, which, having left Brodie, is now encroaching on the Dalvey Woods, resents being separated from the main body in this fashion and is taking revenge. Kincorth, Dalvey and Moy, all present features of considerable interest to the forester; but in recent years the experiments at Binsness have been attracting most attention, and may be described first.

The estate comprises some 558 acres. In 1667, it fetched a rental of £391, 17s. 2d. Scots, which, with the additional payment in kind which was then customary, would probably be equivalent to over £1000 sterling at the present time. After several changes of ownership it was sold in 1865 for £660. Grigor says of it at that time, "It possesses no plantations whatever; and its arable lands have been abandoned to desolation."

I have been unable to verify whether Major Chadwick was the party who bought the estate in 1865. At any rate he was proprietor in 1871 when he began planting. At first his object seems only to have been that of beautifying his miniature desert, and of providing shelter for game and for the house which he had erected. Later on, he became more and more interested in the work in its forestry aspects; and it is gratifying to note that his son, Mr James M. Chadwick, is carrying it on with the same enthusiasm.

As already indicated, the areas on which trees have been planted in Binsness can be divided into three groups, in much the same way as those at Brodie—low ground 2 to 3 feet in depth overlying a substratum of moss, middle-sized dunes and large sand-hills.

The first planting was carried out on the more level areas in the neighbourhood of Binsness House, a sum of £214 being expended to begin with. Scots pine, birch and spruce were used. The spruce, as one would expect, proved a failure, but the branches came in useful later on for fixing the sands in the more recently formed plantations. The birch did extremely well, but is now proving somewhat of a nuisance, naturally regenerating itself where the Scots pine might otherwise obtain a footing. Later on, in 1885, Maritime pines were planted. They have now reached a height of 33 feet, and are exceedingly graceful. Some twelve years ago, the spruce and some of the Scots pine were removed, and the vacant ground planted with Japanese larch and Douglas fir. While in both cases the results are promising, the Douglas is in parts badly attacked by *Trametes radiciperda*, but this seems to happen only where the sand is shallow and resting on a water-logged mossy subsoil, permeated with iron. Groups of Japanese larch and European larch were planted side by side in another part of the estate in 1903. The European larch has become somewhat yellow in the foliage, and is badly cankered; while the Japanese larch shows every sign of being healthy. The first Corsican pines were planted in the low ground in 1898.

The larger proportion of the woods at Binsness have been planted on the medium-sized dunes, the species chiefly employed being Scots pine. Twenty-five acres of this species were planted on the exposed portion of the ground called Findhorn Hill, in 1875. The plantations are all in a satisfactory condition, but on

FIG. 6. MAVISTON SAND-HILLS, ELGINSHIRE.

After the sand has passed over the trees, as shown in Plates III. and IV., the area which has been devastated is again naturally regenerated with seed from the surrounding woods, and a thick growth of Scots pine covers the ground.

FIG. 7. BINSNESS, ELGINSHIRE.

Douglas fir: both Oregon and Colorado varieties planted about 12 years ago on the flat sands. When the first crop consisting of spruce, maritime pine and birch was removed a few standards of the birch and pine were left. The Oregon Douglas appears to be much healthier than the Colorado variety.

[*To face p.* 24.

FIG. 8. BINSNESS, ELGINSHIRE.

Spruce branches which have been used to fix the sand on the large hills (Plate IV. Fig. 5). Young plantation of Corsican pine.

FIG. 9. BINSNESS, ELGINSHIRE.

Corsican pine planted 1911-12 on large sand-hills (Plate IV. Fig. 5). Note the Marram grass which is spreading rapidly.

the westward side show the effects of the prevailing winds. Individual trees are often attacked by the pine rust, *Peridermium pini*, and also by *Retinia resinella*. A small area of these dunes was planted with a mixture of Scots and Corsican pine in 1903. The Corsican pine has, here, completely surpassed the Scots pine in height and girth. It has also beaten the Corsican pine planted on the low ground in 1908. The success of this species seems to be due to its adaptability for growing on sand and to its power of resisting wind. The trees develop very stout stems at an early age, and their tap roots are quickly replaced by long radiating side roots which resemble the underground stems of the Marram grass, as they run through the sand some 6 inches below the surface. On a plant 7 to 8 years old, three or four such roots, each about 15 feet in length, are commonly found. They give the plants an excellent hold of the sand. As regards the timber formed, it seems to me that it gives promise of being cleaner and freer from knots than the timber the Scots pine produces in the same situation. The latter species is apt to become very branchy when growing in soils consisting almost entirely of pure sand. The Corsican pines at Culbin, unlike the Scots pines, do not show any sign of developing this objectionable feature, the branches remaining comparatively small. It is further interesting to note that the younger branches of the Corsican pine are remarkably succulent in spite of the difficulties they must have in obtaining moisture, while in the case of the Scots pine they are dry and brittle.

After carrying out these experiments on the lesser dunes and flat areas, Major Chadwick extended his operations to the large sand-hills on the north. As these sand-hills are, to begin with, quite bare of any covering, it is specially necessary to see that the sand is properly fixed before carrying out any planting. First of all, the sands for some distance to the west of where it is proposed to plant are fixed with Marram grass. The grass is transplanted from places where it is growing thickly. As it possesses great vitality, much care need not be taken in the operation. It is simply inserted in holes made in the sand, when it quickly produces long runners and spreads rapidly. In the area where the planting is to take place, spruce branches are laid down with their ends inserted in the sand on the windward side. Recently, about three hundred loads of spruce brushwood were carted on to these large sand-hills. The carting is done

when there is a hard frost, as at any other time the cart-wheels would sink. All the sweepings from the hay-loft are also deposited amongst the young trees, so that the ground quickly becomes covered with a vegetation of weeds and grasses. The sowing of Lupin has not been found to give good results, but broom comes up thickly wherever handfuls of the seeds are scattered, and is often afterwards transplanted to other places which are in process of being fixed.

Fencing.—The area to be planted is enclosed with wire-netting, as rabbits are plentiful. Only one, or at most two, wires are used to support the netting, so that the fencing is not expensive.

Planting.—In planting, a V-shaped notch is made with an ordinary spade or with one of the Schlich pattern with a very broad top. The plant is then inserted, and the sand simply forced into the hole with the foot. The best time for planting is towards the end of March or the beginning of April. It is advisable, if possible, to plant immediately after rain, as, if the sand is not moist on the surface, it must be scraped away until a moist layer is reached. Two-year seedlings are always used. The cost of planting is not high.

Cost of labour	10s. per acre.
Cost of carting brushwood, 4 loads per acre .	4s.
Plants, 4s. 6d. per thousand . . .	13s.
Total . .	27s.

Or, say, 30s. per acre exclusive of fencing.

Some 30 to 40 acres were planted in this fashion amongst the great sand-hills about eight years ago. The species mostly used was Corsican pine; but Banksian pine, Douglas fir and larch were planted in subordinate numbers. The Corsican pine has proved itself the most suitable, and is now the only species planted. During the last three or four years another area of 40 to 50 acres has been planted with it in the very midst of the large hills, and the plantation has again proved successful. It seems wonderful that these young plants do not become buried in the sand which, in spite of the care that has been taken to fix it, is continually being driven hither and thither by the wind. The young plants are almost covered over again and again; but, so long as the tips of their long, conical end buds keep above the sand, they manage to come away.

The Binsness plantations will undoubtedly in years to come

form a splendid monument to the care which the Chadwick family have bestowed on their formation.

In the case of the Dalvey, Kincorth and Moy plantations, the trees cover only the sands spreading over the low-lying ground and medium-sized dunes. Some interesting records of them are left by Grigor. He states that the first planting was carried out at Kincorth in 1839, and that it was the earliest experiment in the afforesting of sand dunes carried out in this country. In 1865, the 26-year-old trees were valued by the proprietor at £30 per acre. Grigor himself planted 199 acres on the Moy estate with Scots pine and larch 2-year-old seedlings and 1-year transplants at an average cost of 10s. 4d. per acre, exclusive of fencing. In 1842, he planted an additional 74 acres at 8s. 9d. per acre. The proprietor planted another 25 acres. The total cost for the 298 acres, inclusive of £84, 16s. spent on the partial fencing of the area, amounted to £232, 18s. 7d. In 1865, he states that "the plantations on the Culbin sands belonging to Moy are now 22 to 24 years old, and form a very compact wood of nearly 300 acres. The tallest larches are about 48 feet high, and the best Scots pines 20 to 30. . . . In 1864, prop wood yielding, according to a statement furnished by the factor, a return of £482, 6s. 8d. was sold, and a further sale of £400 was expected before the necessary thinning was effected. . . . From its present healthy state, 1865, the forest cannot be valued at less than £22 per acre, or altogether £6556" (Grigor's *Text-Book on Arboriculture*, pp. 102-106).

It is interesting to compare the planting carried out at Culbin with the similar experiments carried out on a much grander scale in various parts of the Continent. In the Landes in the South of France, the dunes seem to be somewhat similar to the large sand-hills at Culbin, but cover a much more extensive tract of country, and are proportionately more destructive. They also have been responsible for the overwhelming of villages and farms; and it was an endeavour to arrest their destructive progress that has been the means of giving us one of the world's greatest experiments in the reclaiming of waste and barren land. The Government of France commenced this work in 1851. Before afforestation could be safely carried out, it was necessary to guard against future incursions from fresh material thrown up by the sea. This was done by driving palings into the sand some distance from the high tide level. As the sand covered up

these palings, they were gradually raised, until a regular artificial barrier dune, 35 to 40 feet in height running along the shore, was formed. This dune was then fixed by sowing and planting Marram. On the sands behind, Maritime pine seed was sown alone, or mixed with the seeds of Marram grass, whins and broom. The area sown was then covered up with brushwood, heather, whin and broom. As is well known, these operations have not only arrested the progress of the sand, but have transformed the Landes into one of the most prosperous districts of France, the centre from which we derive our supplies of French turpentine, and a large proportion of our supply of pit props. Similar experiments are carried out on the shores of the Baltic in East Prussia. Here, after the barrier dune is formed, fir branches, heather or broom are laid down on the sands behind, and the planting is carried out with fairly old plants of Scots or mountain pine.

To come nearer home, the Balgownie Golf Links were threatened by sand blowing through the gulleys and clefts which form breaks in the embankment which runs along the coast. Two years ago, gratings were placed across these clefts, so that they might become filled up with sand. As an extra precaution, the sloping sand on the seaward side of the embankment was planted with *Psamma arenaria* and *Elymus arenarius*. At first it was feared the sea would wash out the grasses, but instead of this happening they are driving back the sea, and the sand which they are collecting is forming a new outer dune some 15 yards in advance of the old one. Since the grasses were planted the Don has altered its channel, retreating from the Balgownie side towards the north, but it is doubtful whether they are in any way the cause of this departure from traditional habits on the part of the river.

5. Observations on the Annual Increment of Spruce, Scots Pine and Japanese Larch.

By J. H. Milne Home.

Some notes upon this subject were published in the *Transactions* on three previous occasions (vol. xxiv. p. 52; vol. xxvi. p. 160; and vol. xxvii. p. 34). The records for some of the plantations have now been taken for five years, and others have been added from time to time which also give interesting results.

The means by which the observations have been taken, and the nature of the soil and situation of the different areas, have been referred to in the earlier articles and need not be again detailed.

The object of this article is to summarise the results so far obtained, and to point out such conclusions as may be of value in forestry statistics and calculations.

The table on page 30 gives an abstract of the results for each plantation separately. Five stems have been taken in each group.

The mean annual increment is calculated without any allowance for intermediate returns from thinnings, regarding which there are no records. The cubic measurements are quarter-girth.

The plantations not referred to in previous articles are B (spruce), and D (Japanese larch). The former is on a soil which was formerly hill pasture of moderate quality, with thin peat lying on a somewhat retentive subsoil. The aspect is easterly. The Japanese larch are growing on what is undoubtedly a favourable soil, consisting of a good loam with a considerable deposit of humus. The aspect is easterly with a good slope.

The four spruce areas are typical of different soils and elevations between 250 feet and 600 feet. Two are on fairly good soil, and two on poor soil. They also present considerable variation as regards density and number of stems per acre. In no instance has the early management of these crops for, say, the first 15 or 20 years been ideal, and better results should certainly be got from young woods recently established. In spite of such drawbacks it appears that a mean annual increment of fully 70 cubic feet per acre has been secured, with a current annual increment

Plantations	Year	Age	Estimated growing Stock	Number of Stems per acre	Average Diameter	Mean annual Increment	Present per cent. rate of Growth	Current annual Increment
			Cub. ft.		Inches	Cub. ft.		Cub. ft.
I—Spruce	1910	40	2800	280	11·5	70	4·16	116
,,	1911	41	2916	280	11·7	71	3·54	103
,,	1912	42	3019	280	11·8	72	3·75	113
,,	1913	43	3132	280	12·0	73	3·37	105
,,	1914	44	3237	280	12·2	73	3·09	100
			Five years' Average			72	3·58	107
K—Spruce	1911	38	2700	700	8·6	71	3·29	89
,,	1912	39	2789	700	8·8	71	3·12	87
,,	1913	40	2876	700	9·0	72	2·98	86
,,	1914	41	2962	700	9·1	72	2·75	81
			Four years' Average			71½	3·03	86
D—Spruce	1910	32	1320	450	6·8	41	6·95	91
,,	1911	33	1411	450	7·0	43	6·58	93
,,	1912	34	1504	450	7·2	44	6·35	95
,,	1913	35	1599	450	7·4	46	6·16	98
,,	1914	36	1697	450	7·6	47	5·80	98
			Five years' Average			44	6·37	95
B—Spruce	1912	36	2645	680	7·3	73	3·60	95
,,	1913	37	2740	680	7·4	74	3·78	103
,,	1914	38	2843	680	7·6	75	3·51	100
			Three years' Average			74	3·63	99
I—Scots Pine	1910	40	1730	280	10·4	43	4·27	67
,,	1911	41	1797	280	10·5	44	2·59	46
,,	1912	42	1843	280	10·6	44	2·67	49
,,	1913	43	1892	280	10·7	44	2·76	52
,,	1914	44	1944	280	10·8	44	2·37	46
			Five years' Average			44	2·93	52
K—Scots Pine	1910	37	1200	710	6·2	33	4·24	51
,,	1911	38	1251	710	6·3	34	4·75	59
,,	1912	39	1310	710	6·4	34	4·41	58
,,	1913	40	1368	710	6·5	34	3·71	51
,,	1914	41	1419	710	6·7	35	3·65	52
			Five years' Average			34	4·15	54
D—Japanese Larch	1913	9	980	1050	4·2	109	12·86	126
,,	1914	10	1106	1050	4·5	110	12·01	133
			Two years' Average			110	12·43	130

varying from 86 cubic feet to 107 cubic feet per acre. With rather more care given to the establishment of the crop, up to the period when a complete canopy is obtained, better results by at least 20 or 25 per cent. should be secured. With regard to the question of the most profitable length of rotation, larger experience is necessary before expressing a definite opinion. It would seem, however, that on poor soils such as K (spruce) the rotation for a first crop of timber should not be long. It will be noticed that at the age of 41 years the mean annual and current annual increments are already approaching, which would indicate the most profitable age for felling to lie between 50 and 60 years.

The two Scots pine areas are examples of good and bad soils. The crop I (Scots pine) has been over-thinned. It will be noticed that the results of the two areas are very similar, and both the mean annual and current annual increments are poor. This merely confirms what is evident from an inspection of the relative growth of spruce and Scots pine in the district—that the former as a timber producer is worth at least twice as much as Scots pine.

The results obtained from Japanese larch are very remarkable, but they have not yet continued long enough to draw any exact conclusions. Growth is, however, marvellously rapid, and it seems probable that whole areas could, if wished, be cleared for pitwood between the ages of 15 and 20 years.

There are no crops of Douglas fir or Menzies spruce which are as yet sufficiently advanced to make measurements possible. On fairly good soils the growth of Douglas fir should be equal to or exceed that of Japanese larch. Menzies spruce is not likely to give quite so high a yield, unless after the age of 20 years, but the growth considerably outstrips that of the common spruce.

There can be little doubt that the importance of fairly accurate information regarding growing stock, annual increment, and annual fellings, in terms of cubic feet per acre, has been insufficiently studied by those having charge of the management of woods in Scotland, and comparatively few foresters could give, even approximately, correct information upon these points regarding the whole woods under their charge. So far as coniferous woods are concerned, it seems fairly clear that the minimum return which should be expected is 60 cubic feet

per acre per annum. If this standard is not being reached, there is a fairly strong presumption either that the management is defective, the wrong species is being grown, or the soil and elevation are such that profitable forestry is doubtful or impossible on the particular area in question. Many middle-aged and nearly mature crops may fall considerably below such a standard, and the problem set before the forester in these cases is—how and when to realise such crops to the best advantage, so as to replace them with fresh crops of the most suitable species established under proper conditions.

The results shown in the foregoing table are merely averages for each area. To give the details for each stem would have occupied too much space. Part of the object of the investigation was to ascertain in what months growth was actually made, and to endeavour to trace what connection, if any, existed between weather conditions, such as rainfall, and timber increment. The following are the results obtained :—

Plantations	Year	Percentage rate of growth in					Total
		May	June	July	Aug.	Sept.	
Spruce (2)	1910	19	32	22	18	9	100
,, (3)	1911	28	29	19	15	9	100
,, (4)	1912	21	30	29	16	4	100
,, (4)	1913	20	35	24	16	5	100
,, (4)	1914	18	20	14	42	6	100
Five years' Average		21	29	22	21	7	100
Scots Pine (2)	1910	15	32	47	6	...	100
,, (2)	1911	27	28	16	25	4	100
,, (2)	1912	31	37	15	15	2	100
,, (2)	1913	23	32	17	23	5	100
,, (2)	1914	17	25	15	39	4	100
Five years' Average		23	31	22	21	3	100
Japanese Larch (1)	1913	19	34	32	15	...	100
,, (1)	1914	17	40	10	32	1	100
Two years' Average		18	37	21	23	1	100

Such differences as appear tend to show that timber increment on the main stem commences two to three weeks earlier on a good soil than on poor soil; and that on peat little or no increment is made until the ground is fairly dry. This is

even more marked with Scots pine than with spruce. As an instance, in plantation K, the Scots pine in 1910 did not commence to lay on wood until June, whereas in 1912, 46 per cent. of the whole season's growth was made in May. In the former year April and May were wet and sunless, in 1912 these months were unusually dry. The rainfall during the first half of the summer of 1914 was unusually light, and the result is most clearly shown in the table by the restricted growth of spruce in June and July, followed by a rapid growth in August after rain had fallen. In the case of plantation B (spruce) no less than 69 per cent. of the whole season's growth in 1914 was made in August. The total increase in girth does not vary widely, taking one season with another, but the month in which the largest increase is made seems to depend greatly on rainfall. A season cannot apparently be too wet for spruce, but for Scots pine a moderate rainfall gives the best results. The growing season for both spruce and Scots pine appears to extend from the middle of May to the first week of September, the spruce having slightly the longer growth of the two. The largest average percentage of growth is made in June (30 per cent.), the months of May and July being practically equal (22 per cent.). There is a slight falling off in August, as compared with July, and September accounts for only 5 per cent. of the total increment.

Particulars of rainfall for the five years may be of interest for comparison.

Year	May	June	July	Aug.	Sept.	Total
	Inches	Inches	Inches	Inches	Inches	Inches
1910	2·51	1·98	6·10	8·73	·86	20·18
1911	3·21	2·78	1·80	4·29	4·30	16·38
1912	2·19	5·18	3·22	5·95	2·64	19·18
1913	3·29	2·78	1·18	3·02	2·14	12·41
1914	2·42	1·01	3·59	5·43	3·08	15·53
Five years' Average	2·72	2·75	3·18	5·48	2·60	16·73

6. On the Production of Potash Salts from Woodlands and Waste Lands.

(*With Plate.*)

By G. P. Gordon, B.Sc.

It is now a matter of common knowledge that, as a result of the European crisis, the main supplies of potassium salts have been cut off, and there is every reason to believe that the stocks of these in Scotland will be completely exhausted by April 1915. The annual consumption, in Scotland, is approximately 25,000 tons of low-grade salts having a potash content of from 10 per cent. to 15 per cent. (K_2O), and 500 tons of high-grade salts containing from 40 per cent. to 50 per cent. potash (K_2O).

These potash salts are used in a large number of industries, *e.g.*, soap-making (soft soap); glass-making; pottery manufacture; artificial manure making; electro-plating, gilding and electro-gilding; dyeing, bleaching and fixing processes; manufacture of gunpowder and pyrotechnic materials; manufacture of lucifer matches; calico printing; extraction of gold by the "cyanide processes"; manufacture of soluble glass; tanning; manufacture of prussian blue; case hardening of iron; salting and pickling of meat; photography.

The chief potash compounds used for industrial purposes are the carbonate, sulphate, chloride, hydrate, chlorate, cyanide and nitrate. In addition certain potash salts are used medicinally, *e.g.*, the iodide, bromide, acetate, bicarbonate, citrate and chlorate.

It has long been established that the ash of plants is rich in potash salts, of which, as the analyses show, anything from 3·5 per cent. to 26 per cent. may be obtained. The following analysis was made of a sample obtained by lixiviating wood ash with boiling water and evaporating to dryness, and indicates the manner in which the potash is combined with the various acid radicles in the wood ash. The analysis was made by the City Analysts, Glasgow.

	Per Cent.
Carbonate of Potash	33·20
Sulphate of Potash	24·66
Chloride of Potash	8·25
Phosphate of Potash	·14
Potash combined as Silicate	1·04
Soda combined as Silicate	·50
Silica combined with Potash and Soda	3·65
Insoluble Matter	·20
Water, etc.	28·09
	100·00
Total Potash (K_2O)	42·46

The relative proportions of these salts are also indicated, and it is observed that the bulk of the potash occurs as carbonate and sulphate, which are the two most important potassium salts.

As forest contains by far the largest volume of plant tissue per unit of area of any land, it was decided to conduct experiments relating to the production of plant ash in woodlands. The investigation was extended to include land producing a dense volume of weed growth, such as is obtained in the case of bracken land. The experiments were conducted with due regard to present economic conditions, and all calculations of costs are based upon these.

Quantities Available.

It was not deemed advisable to give separate figures for different types of woodlands, *e.g.*, high-forest, coppice and scrub, since the density of stocking varies so much. It was found however, that taking the "lop and top," undergrowth, weed growth and litter, in any average type of woodland about half a ton of ash was produced per acre. On the basis of there being three million trees cut this year for pitwood and other purposes in plantations containing on the average three hundred trees per acre, some five thousand tons of ash would be rendered available.

In all portable saw-mills and foreign timber-mills where wood constitutes the fuel, ash is a by-product. On investigation it was found that such mills produce about quarter of a cwt. of ash per day. Throughout Scotland there are probably not less than five hundred mills producing wood ash, which, if they work

three hundred days in the year, yield approximately two thousand tons of ash.

As regards the actual acreage of land under bracken in Scotland no data are available, but it may be taken that there are at least the equivalent of twenty thousand acres of fully stocked bracken land, from which ash could be readily made available. In the experimental tests with bracken one ton was produced per ten acres, so that a total of some two thousand tons of bracken ash could be guaranteed.

From the above three sources a total of nine thousand tons could be put on the market within the year, at a moderate cost, and with no disturbance to existing industries.

Certain other small sources of supply might be mentioned; for example, the material obtained in clearing up the leaves, twigs, hedge clippings and shrubs from policy grounds and gardens, yields, on burning, an ash which has a high potash content. Further, if an efficient and economic means of burning sawdust, chips and bark could be devised, a large and fairly valuable supply of ash could be obtained. In this connection, it should be mentioned that the parts of a tree richest in potash salts are, first, the leaves or needles and buds, next, the bark, then the twigs and branches, and finally, the timber.

Method of Production.

Perhaps the most important point in connection with this is the fact that no plant is necessary, the work being done as in ordinary "clearing and burning" operations. Heaps of "brush" are made on places where there is a good flat bottom for the fire, and where easy access is obtained to a large amount of material (Plate VII. Fig. 1). The fires are started and are kept going for two or three days until the particular area is cleared. It is found better to have two or three fires than to have one large fire, since labour is saved in dragging. The fires each night should be well "banked" with green material, and in wet weather may be covered with sheets of old corrugated iron. Where fires are made on sloping land, a shallow trench should be excavated on the top side to carry off surface water. The fires require no special attention until burning is almost complete, when the embers should be stirred occasionally until all the ash is in the form of a fine white powder.

The organisation of labour for this presents no difficulty.

FIG. 1. "BRUSH" READY TO BE BURNT FOR POTASH.

FIG. 2. MILL FUEL READY FOR BURNING.

FIG. 3. BRACKEN COLLECTED FOR BURNING.

[*To face p. 36.*

Proprietors and timber merchants are regularly in the habit of conducting these operations, and usually have the necessary labour at their disposal. The price obtained for the ash will allow them to augment their staffs, which will result in an increase of local employment. This employment is of a very light nature, so that old persons and even women and children might be employed.

In the case of mill fuel (Plate VII. Fig. 2) the method of production is exactly as at present; it therefore entails no increased labour bill.

As regards bracken land, this is treated in a similar manner to woodlands. After the bracken has been cut it is collected into convenient centres (Plate VII. Fig. 3) and there burned. The best time to cut bracken for this purpose is during the months of August, September and October, or even later, if necessary. The labour required to produce bracken ash could probably be readily supplied by estate and farm staffs.

In all the above methods of production it is essential that the ash be kept as dry as possible, since the potash salts are soluble in water. The ash from the various types of fires, when cool, is put through a three-sixteenth-inch sieve, after which it is either bagged directly or put into barrels or large wooden ash-bins. It is necessary that at each centre of collection the various types of ash should be well mixed, so as to ensure the obtaining of a uniform product.

Cost of Production.

The figures given are representative of the cost in cases where the total is put against the ash, and they may be taken as indicative of average conditions under which production takes place. The proved costs of production show considerable variation, ranging from 40s. to 50s. per ton in the case of bracken land, and from 50s. to 60s. per ton in the case of woodlands.

The costs of production from woodlands and from bracken land should not, however, be taken at their face value. In the case of the former, the ash is in reality a by-product, since the operation of "clearing and burning" is necessary in order to make possible the replanting of the area, and to afford protection against insect and fungoid attacks. Further, timber merchants sometimes undertake "clearing and burning" in their contracts, since the clearing of the area, as felling operations proceed, facilitates and cheapens the cost of extraction of the timber. In the latter case, the increased value of pasture from which bracken

has been cleared has been shown in some cases to more than pay the cost of cutting.

Results of Analyses.

The following are the results of the analyses of six samples which represent the various materials and methods for the production of potash salts:—

	Engine Fire		Forest Fire		Open Fire	Closed Fire
	A Hardwood Ash	B Softwood Ash	C Hardwood Ash	D Softwood Ash	E Bracken Ash	F Sawdust Ash
Soluble Potash	7·87	3·60	9·30	7·60	15·51	1·89
Insoluble Potash	2·47	2·55	3·50	5·55	10·77	1·08
	10·34	6·15	12·80	13·15	26·28	2·97
Soluble Phosphates	None	None	None	None	None	None
Insoluble Phosphates	11·45	8·97	23·37	17·17	8·93	2·79
Citric Soluble Phosphates	...	...	...	11·17	7·82	...
Insoluble Matter in Water	87·68	95·00	84·44	80·42	77·50	94·96

The following two samples were collected under perhaps the worst possible conditions. Sample G is from a forest fire, and has a considerable quantity of soil mixed with it due to careless lifting, in addition to having been exposed to the elements for some time. Sample H is from a mill in which the fire was damped with water at night, and the collecting barrel of ash was not under cover.

	Forest Fire	Engine Fire
	G Mixed Ash	H Softwood Ash
Soluble Potash	2·25	2·57
Insoluble Potash	1·30	1·33
Total Potash	3·55	4·9
Soluble Phosphates	None	None
Insoluble Phosphates	3·63	5·02
Insoluble Matter in Water	95·56	69·96

The above analyses would seem to show that, generally speaking, the proportions of potash and phosphate in the various types of ash depend mainly upon the method of production. In the case of both softwoods and hardwoods the analyses show that the ash produced in forest fires has a greater potash and phosphate content than ash produced in mill fires. This is probably explained by the fact that in the forest fires there is a larger proportion of branch wood, twigs and leaves, all of which are relatively richer in potash and phosphates than the "slab" material which comprises the mill fuel. The ash of bracken is seen to be very much richer in potash than any types of wood ash, and as bracken is often found in association with coniferous plantations the admixture of bracken ash will increase the total yield of potash from such areas.

Utilisation of Material.

Analyses show that this material as a potash manure is very similar in nature to kainit, and may be used for similar purposes. In addition, however, the wood ash contains a considerable proportion of phosphate which adds greatly to its manurial value. An experiment on a commercial scale showed that the mechanical condition of the ash is excellent; this allows of it being used with advantage in compound manures, in which it functions as a "dryer." According to recent experiments conducted at Rothamsted,[1] "wood ash readily mixes with superphosphate without heat, smell or caking." In this connection, taking for granted that the methods of production, collection, storage and marketing prove successful, it is highly probable that this material could compete successfully with kainit, even in normal times, when it would have an average selling price of about 60s. to 70s. per ton. At the present time, however, a better price should be realised.[2]

High-Grade Salts.

The production of certain high-grade potash salts from the crude ash is a matter which does not present much difficulty. The method consists, in the first place, of extracting the potash lye by lixiviation of the ash with warm water, or with quicklime

[1] See *The Journal of the Board of Agriculture*, vol. xxi., No. 8, p. 697.

[2] On the basis of 4s. per unit soluble potash, and 1s. 3d. per unit hosphate.

and water in a series of vats, and of the subsequent evaporation of the lye in shallow iron pans. For certain purposes, *e.g.*, soft soap manufacture, the lye itself may be used. An experiment was conducted in this connection and good samples of soft soap produced; the bracken ash gave the best results in this respect.

The residue in the vats, when dried, has a certain manurial value, as it consists largely of calcium, carbonate and phosphate. The calcium phosphate contains about 8 per cent. of phosphoric acid, and the wet residue has a water content of from 50 to 60 per cent.[1]

Marketing.

It has been suggested that probably the best method of marketing would be to store the material at the various centres of production in quantities of from 5, 10, or 15 tons. The material should be well mixed in bulk before being finally bagged. A sample should then be taken from the heap and sent for analyses and assessment, after which the consignment may be sold direct to the purchaser.

7. The District Advisory Forest Officers of the Board of Agriculture.

As is well known, the Board of Agriculture for Scotland intend in the near future to appoint three District Forestry Officers, whose services will be available to proprietors of woodlands and plantable lands in Scotland. One officer will be attached to each of the three agricultural colleges, and his services will be available in the area served by the college to which he is attached.

When these appointments have been made, the duty of the officers will be to give advice generally on forestry management, and their services will be further available for the preparation of simple working-plans for woodlands and plantable lands which the owners desire to treat mainly for profit. It is hoped that this arrangement may be the means of initiating considerable improvements in timber growing. The services of the District Advisory Forest Officers will be given free of any further charge

[1] See *The Forester*, Nisbet, vol. ii. p. 608.

than a contribution of 10s. per day towards the actual travelling and incidental expenses incurred in connection with field work and the preparation of such plans.

But before any District Advisory Officer can begin the field work certain preliminary information will be required, and the landowners will be asked to furnish the Board with various details. These details are indicated in the annexed memorandum, and forms for making the returns will be supplied by the Board.

MEMORANDUM detailing the Preliminary Information needed before the Board of Agriculture for Scotland will be prepared to lend the services of a District Advisory Forest Officer for preparing Working-Plans for woodlands and plantable lands which landowners may wish to work for profit:—

1. Situation (County and Parish); area and general description of the estate: and its legal position (whether held entailed or in fee simple).

2. *Summary* of the total area (in acres) of the woodlands and the lands intended to be planted.

	Acres.
A—Ornamental Woods, Shelter-belts, Game Coverts, etc., not intended to be worked for profit	
B—Broad-leaved Woods and Plantations, and old Coppices and so-called "natural woods," intended to be worked for profit . .	
C—Conifer Woods and Plantations intended to be worked for profit	
D—Land intended to be planted	
Total Area .	

3. *A Complete Register* of all the woodlands summarised under A, B and C, and of the plantable land under D, giving full details of all the woods and plantations, etc., to which the working-plan is intended to apply. Each separate compartment of wood, plantation, coppice, or land for planting, should, in each of the classes A, B, C and D, be numbered (*seriatim* in each class) and named, the kind of crop and the age of the crop given for classes A, B and C, and the area (in acres) stated.

Such a Register may conveniently be sent in the following form :—

No. of Block or Compartment. Section of Block	Name of Wood	General Description of Present Crop	Actual or Approximate Age : Years	Area : Acres
A—Ornamental Woods, Shelter-Belts, etc., not intended to be worked for profit.				
1 2 etc.				
			Total .	
B—Broad-leaved Woods and Plantations, and old Coppices and natural woods intended to be worked for profit.				
1 2 etc.				
			Total .	
C—Conifer Woods and Plantations intended to be worked for profit.				
1 2 etc.				
			Total .	
D—Land intended to be planted.				
1 2 etc.				
			Total .	
Gross Total Acreage of Woods, Plantations, Coppices, and Land to be planted				
			Total .	

4. *A Stock Map* (Ordnance Survey on scale of 6 inches to the mile, preferably with contour lines in counties for which such maps are obtainable), showing the exact situation of each wood, plantation, coppice, or piece of plantable land, numbered so as to correspond with the blocks enumerated serially in the Register under each of the classes A, B, C and D, and coloured distinctively to show at a glance to which of these four classes any area belongs, and (in the case of wooded areas) the particular age-class in which each numbered block or part of a block is properly classifiable.

To ensure uniformity it may be convenient to use the following colours:—

For Class A, *pale carmine.*
" B, (1) *burnt sienna* (in 4 shades).
" C, (2) *green* (in 4 shades).
" D, *pale Indian ink.*

In each class of woodland the *age-class* to which each block or part of a block properly belongs should be shown by the depth of the tint of the colour distinguishing that class, the youngest woods or plantations being colour-washed with the lightest tint, and the oldest being coloured with the deepest tint.[1]

As regards this colour-scheme it may be noted that, in Class B, if woods of the oldest age-class are being naturally regenerated, this can be shown by colouring such areas with the palest tint (indicating the youngest age-class) and cross-hatching broadly with the darkest tint (indicating the age of the parent standard trees). And in the case of conifer woods, Class C, intended to be worked with an 80-year rotation, the age-classes would most conveniently be "under 20 years," "21 to 40 years," "41 to 60 years," and "over 60 years"; while if intended only for growing pitwood to be cut at about 40 years of age, the most convenient classification would be "under 10 years," "11 to 20 years," "21 to 30 years," and "over 30 years."

5. Information about the configuration of the ground; elevation; aspect; degree of exposure to wind; gradient of the hillside and the land intended to be planted. Information will also be useful as to the total acreage of the woodlands and of the land for planting (*a*) under 500 feet elevation, (*b*) between 500 and 1000 feet, and (*c*) over 1000 feet.

[1] A colour plate is appended to the Memorandum.—Hon. Ed.

6. Details regarding the *rainfall*; the specific nature, depth, degree of moisture, general quality, and present condition of the *soil;* the character of the *soil-covering* (heather, bracken, etc.); the nature of the *subsoil*, and the extent to which *drainage* will probably be needed.

7. The general character, condition, and estimated value of the present woodland crops.

8. The state of the fences and boundaries.

9. Dangers to which the timber-crops seem to be exposed, and damage done during the last ten years or so from—

(*a*) Gales, including direction of wind and month of the year.

(*b*) Heavy snow in young plantations, and in older woods.

(*c*) Frost, and when most severe.

(*d*) Drought, and when most severe.

(*e*) Insects.

(*f*) Fungus diseases.

(*g*) Game and rodents (deer: red, roe, or fallow; hares and rabbits; black game; squirrels; mice and voles, etc.).

(*h*) Fires, and their causes.

(*i*) Strong growth of weeds in young plantations.

(*j*) Lightning.

(*k*) Smoke and other atmospheric impurities.

10. Statistics relative to the management during the last ten years or so regarding—

(*a*) The average area (in acres) of the fall made annually; and the average area planted annually.

(*b*) The yield in timber and other wood per acre for the different kinds and classes of wood cut year by year; and the estimated market value of the same.

(*c*) The number of foresters, permanent woodmen, and temporary labourers employed in the woodlands.

(*d*) The customary method of planting, the age and size of plants used, and the average cost per acre of soil preparation, drainage (when necessary), planting, beating up, and weeding young plantations.

11. Information regarding the best markets hitherto for timber and other wood, and the present market prices for timber, etc.

12. The nearest market for timber; the extent and state of the woodland roads, and the facilities for extracting, converting,

and transporting timber, etc., for sale; and any intention of opening out new roads.

13. The local wood-consuming industries, and the possibility of introducing new wood-consuming industries that might utilise locally-grown timber, etc.

14. Results of any experiments made with such trees as Japanese larch, Douglas fir, common and Menzies spruce, *Thuja plicata*, silver fir, cypresses, etc.

The above is the information which will be asked for before a District Advisory Officer can begin the outdoor work necessary for drawing up any good, simple working-plan.

8. Continental Notes—France.

By A. G. Hobart-Hampden.

French forestry magazines have this year broken off with the advent of the war, and there has, therefore, been less material to consider than usual.

I. In my last year's notes I quoted Huffel as saying that, while the characteristics of the different *races* of the Scots pine are always transmitted wherever the seed is sown, these differences gradually disappear till the foreigner has grown in all respects like the indigenous tree. This has, however, now been denied by Hickel, a French forester, known best, perhaps, on the botanical side of forestry. He says that Dr A. Henry and Mr Forbes (Mr A. C. Forbes no doubt) agreed with him as to the difference between a crop grown from Riga seed and one grown from Haguenau seed which he showed them in France. The context appears to show that he is speaking of old woods, otherwise it would be no confutation of Huffel's statement.

M. Hickel says that, in his opinion, there are practically only two races of Scots pine, the one growing in high latitudes or altitudes, and the other in low latitudes and altitudes. The former is tall, straight, with relatively thin branches, short and dark-coloured needles, and a conical habit; the other has thicker branches, longer and lighter-coloured needles, and a more extended crown. The conical habit of the former tree—with flexible branches and short needles—has no doubt arisen through Selection, as best suited to throw off snow.

II. The *Revue des Eaux et Forêts* mentions a new edition

of Lorey's *Forest Encyclopædia*, edited by Wagner. This is a manual of German forestry as complete as it can possibly be, and since the present state of politics is such that for many a year now none of us will be able to go and see things for ourselves in Germany, it will only be possible to learn about their forestry methods from books. No one, of course, doubts the importance of those methods, even though they may sometimes be somewhat meticulous. This work is divided into all the various branches of the subject, and each part is written by a professor of the highest authority. The name of the book, which is in four large volumes (not to be bought separately), is *Handbuch der Forstwissenschaft*, by Lorey, third edition by Wagner, published by Laupp, Tübingen, price 105 francs, or bound, 125 francs.

According to M. Versepuy, however, the part called "Administration," by Schwappach, has a grave error in it, and M. Versepuy's statement exactly agrees with Huffel, whose observations on the subject of the results in Germany from the seed of Scots pine from Auvergne were mentioned in these notes in last year's *Transactions*. Schwappach states emphatically that the seed from Auvergne has resulted in absolute disaster over very extensive areas in North Germany, from Holland to Russia The fact of the disaster, and the fact that the seed was from Auvergne, are both true; but, according to M. Versepuy, the inference is entirely false. The inference is that Auvergne seed cannot safely be employed. Our author states that the plantations which have failed so badly were made about 1895, that is to say, at a date when there was no seedsman's industry in France. At that time, however, there were seedsmen in Germany and Austria, and they were accustomed to import from Auvergne hundreds of waggons of cones collected in August and September, whereas the cone is not ripe till November. The whole outcry, according to M. Versepuy, against the Auvergne seed, which, now that there are French seedsmen, is in French hands, is a trade dodge—a thing, he says, which has actually been admitted.

III. Professor Engler (Switzerland) has found that the seed of the Scots pine will germinate nearly equally well up to 2 years of storage; after 4 or 5 years the power has decreased by half; while after 7 years the power is, generally speaking, reduced to about a tenth of that of fresh seed.

IV. We find in a Norwegian *Manual of Silviculture* by Barth a quotation from another author, to the effect that the limit of existence of forest species is fixed by the mean temperature of the four months of vegetation, June to September. Thus, birch (or at least *Betula odorata*) is content with a mean summer temperature of 45° F., the aspen and the white alder just under 46° F., Scots pine and spruce, 47° F., *Alnus glutinosa*, 54° F., the oak just under 55° F., and the beech 56° F. In Norway 325 feet of altitude corresponds to a reduction in temperature of just about 1° F. These figures should be useful when planting on mountain sides.

We read also that for success in plantation the seed used should not come from a locality of which the mean temperature differs by more than 2·2° F. from that of the place concerned. There are probably few who consider this, or who, if they did, would confine themselves within such narrow limits.

V. We read in Hickel's new book, *Graines et plantules*, useful information concerning acorns. Those which fall early are generally attacked by an insect (*Balaninus*), and are useless. The acorns which adhere firmly to the cup are useless, being unripe. However, after a drought acorns sometimes fall early and are good. Except in this case, September acorns will be no good. Acorns cannot be kept beyond the following spring. The chief thing to be avoided, when storing them, is excessive dessication. A crinkled pericarp, and one within which the nut moves, means bad seed. Acorns do well if kept under running water, or water which is often changed. They will keep well in airy and dry places, provided the temperature is low. A cellar would do well. Sometimes acorns can be successfully kept in what would amount to a silo, under straw or dry leaves covered with earth. In this case the radicle may emerge, but—if the author has been correctly understood—the fact that this will get broken as soon as the acorns are removed for sowing is not a disadvantage, but the reverse, as it results in an abundant production of root hairs. The best way to test the quality of acorns is to cut them. If they cut easily and cleanly, and do not jump under the knife, they are good. The cut surface must be white or yellowish. The idea that a big acorn is worth more than a small one has nothing in it. It has never been shown that a plant from a small seed is, in any given species, inferior to one from a large seed.

VI. M. Emil Mer is making in France careful experiments, scientifically carried out, on the effect of thinning. In the first instance, he has simply compared results in thinned and unthinned plots; the *degree* of thinning is being tested also, but the results will be published later. In the present instance he has dealt with spruce.

Three plots, A, B and C, lying together at the foot of a gentle slope facing north-west, on granitic alluvium, were chosen. They were 20 years old in 1886, when the first inventory was taken. A and C had lost a number of stems through snowbreak and otherwise, while B has retained nearly all the original stems. B and C have been left alone; A was lightly thinned in 1886, but in 1899 25 per cent. of the material was cut out. Inventories were made in 1886, 1899 and 1907. M. Mer gives his results as follows:—

1. Early thinnings, made with the view of favouring the stems of the future, by gradually disengaging them from those around, produce not only an acceleration in the growth of these particular stems, but also an increase in material—and still more in value—of the total of the stems of the plot.

2. The thicket stage passes into the sapling stage some years sooner in a thinned than in an unthinned plot. Since there are fewer trees, these obtain more from the soil and develop a better root below ground and a better stem above ground.

Here M. Mer states, what is probably true, though not a result of his experiments, namely, that since the soil must not be allowed to be dried up by exposure, we should underplant thinned plots with silver fir. This underplanting would use different layers of the soil from those used by the upper stage.

3. In favouring diameter-growth the thinning favours still more growth in money value. At each inventory the value (M. Mer must mean "estimated value," one thinks) per cubic metre was highest in the thinned plot, because of the bigger diameter. At 45 years of age the mean girth of A was ·56 metre, ·54 metre in C, but only ·39 metre in B; while at the beginning it was ·35 metre in A and C, and ·33 in B.

4. From 1899 to 1907 each of the 3545 stems of B had grown in value (*rapporté*) 1·9 centime, while each of the 1361 stems of A brought in 12·6 centimes. In the course of this period each hectare (2·47 acres) produced annually 69·41 francs in B, and 175·25 francs in A—that is more than double. (It is

presumed the author estimates the value from the amount of wood formed.) Thus not only did the individual stems of A produce more than those of B, but the total plot A produced more than the total plot B.

VII. The following is taken from a Swiss magazine:— "Jardinage," or "Selection," as a method of treatment has been reproached with the slowness of its regeneration and consequent loss of growth. This, M. Biolley contends, is not a valid criticism, for:

1. If the regeneration comes slowly it is because it is dominated by trees which themselves grow strongly, compensating, and more than compensating, for any less quantity of material that there may be in the regeneration under Selection, when compared with that under other methods of treatment where the seedling growth is more uncovered.

2. The presence of this under-stage is very useful to the rate of growth and quality of the trees of the upper stage.

3. Further, this under-stage uses different layers of the soil, and also of the atmosphere, thus the diffused light, unutilised in uniform crops, is used by the under-stage of Selection.

4. Loss of time is avoided, the trees which disappear being replaced by substitutes which are there in advance.

All this seems fairly sound if applied to a shade-bearing species. Our author further claims that under this method the soil conditions are ideal, since the soil, he says, is always friable, moist and receptive, with a cover constant but allowing a certain amount of light. He states that the conditions always allow of more than sufficient regeneration, which is a repetition of Gurnaud's contention that, in fact, with a method of treatment like Selection there is no need to trouble about the regeneration, which can take care of itself.

M. Biolley is interesting in this connection when he points out that of the two media from which a forest is built up, the soil and the atmosphere, the latter has much the larger share. He remarks, "We know that the forest does not exhaust the soil, but, on the contrary, enriches it."

M. Biolley contends (and quotes in this sense several notable German authors) that the quality of timber grown under the Selection method is superior to that of timber grown under other methods. He argues that the slow growth of the earlier years results in a hard heart, which is of value, but later on the

treatment allows of faster growth, the stems being more isolated, and thus able to utilise the atmosphere more freely. So far as quality goes this fast growth is not advantageous, as we know, for coniferous timber, though quantity perhaps makes up for this.

M. Biolley is not convincing when he attempts to argue against the contention that Selection-worked forests connote much damage in exploitation. The great reason, in my opinion, why this damage is serious is that the trees are of all sizes, so that trees when felled smash, in considerable numbers, those of somewhat smaller sizes around them; young growth does not suffer to the same extent as stems of intermediate classes, from saplings upwards. There are, of course, other objections to Selection, as, for example, the fact that stems around a gap made for purposes of regeneration twist and turn to get to the light, and so grow crooked—at least in the case of broad-leaved species; and again, that stems are less well cleaned of their side branches than under other systems of treatment.

VIII. M. Jolyet has more to say upon the Robinia. In the Haute Saône they are taking more and more to the formation of meadows for raising stock, and the fences are of wire attached to stakes, about 6½ feet long with a diameter of 5 to 7 inches at the small end. These are made of Robinia, untreated with antiseptics, which last longer than anything else, even than oak. To obtain such stakes a coppice rotation of 15 to 20 years is sufficient. To get good growth a sandy and deep soil is required; still the Robinia will grow in other soils also, and, if the object is to cover bare ground quickly, the strong tendency of the species to throw up root suckers comes in very effectively. Even in thin soils the roots spread in all directions superficially, and after the original stems are cut the whole intervening ground becomes covered with these root suckers. M. Jolyet speaks of cutting the original stems at 10 years. This phenomenon of the production of numerous root suckers as soon as the parent stem is cut is not peculiar to the Robinia; the writer has seen it most strikingly demonstrated with the Shisham (*Dalbergia Sissoo*) in India. One wonders why this physiological fact is not more often utilised to cover bare ground quickly and closely. If a loose bank, for example, were planted with Robinia (or other species of similar faculty), and the stems cut back after a few years, a rapid close covering of the soil, and a network of binding roots, should result. Railway banks with a tendency

to slip might, one would think, be very suitably treated in this way. As a shooting cover, however, the thorny character of Robinia would be an inconvenience, nor could it grow under any overhead cover. A thin soil over chalk cannot be negotiated by the help of Robinia. M. Jolyet thinks the species would be usefully employed to cheapen the cost of raising conifers, using the latter sparsely among the Robinia, which would be destined to extinction when the conifers grew, but it seems doubtful whether the light-crowned Robinia would sufficiently clean the stems of the conifers.

IX. The forest of Compiègne, with the adjoining forest of Laigue, the scene of so much recent fighting, is an enormous mass of woodland—some 50,000 acres—and there are a number of other large forests close by, as Villers Cotterets, Retz, and St Gobain. Compiègne was, till 1870, a Crown appanage, and used for sport, and to this day deer and rabbits are very abundant—so much so that in this "inspection" the annual expenditure on protection against rabbits runs up to some £1000. The species are oak, beech and hornbeam, with some areas of Scots pine and spruce. The spring frosts are so bad as to make seed years scarce. The working-plan, as revised in 1900, divides the area into two parts, the "quartier bleu" and the "quartier blanc." The first comprises all the compartments to be regenerated during the current period (20 years); the second consists of all the rest, where only thinnings take place. The "possibility" is by volume, and the officer in charge may take trees to make up this amount from any point within the blue quarter where cultural considerations most call for a felling. Formerly there was not the same elasticity, and either areas were subjected to fellings when not at a suitable point for regeneration, or fellings urgently required by the condition of the young crop had to be withheld because the position was not the one comtemplated by the regulations. There is now also a further unusual prescription in the direction of elasticity. There are ten working-sections, each, normally, to be worked as a separate unit, but, in order to fit cultural requirements, it is even permitted to make transfers in the amounts annually cut between the several sections, provided always that the total of the "possibilities" of the ten sections added together is not exceeded.

X. The old forest school of Vallombrosa has been done away

with, and Italy has started in its place a new forest school on a very generous scale at Florence. One great point is that there are no less than 60,000 acres of forest to be reached within four miles of Florence. A properly trained forest service is perhaps more needed in Italy than in any other part of Europe, for there are millions of acres of bare land on the mountains. The configuration of the country is such that the "restoration" of the mountains is of very special importance to the agricultural lands below and to the water system. The State is buying land, either already under forest, or bare—this last with the view of afforestation—at a considerable rate. In 1913 alone it seems to have purchased nearly 30,000 acres, and acquisitions amounting to 24,700 acres are contemplated. Besides educating the Government Forest Service, the new forest school will admit others who may wish to obtain a technical forest education—such as proprietors of woodlands, land agents, etc.

XI. France had, before the war, set aside a credit of two million francs as a beginning of forest work in Morocco. The intention was to take in hand the cork oak forests, which are in a terrible state, first, and then to pass on to the cedar forests of Fez and of the Atlas mountains.

XII. The *Revue Scientifique* says that the forests of German Alsace-Lorraine cover 1,111,500 acres, 31 per cent. of the area of the province. Two-thirds are hardwoods, one-third conifers—partly pine (Haguenau), and partly silver fir and spruce (Vosges). 188,500 acres are still worked as coppice. The gross revenue is ten million francs (somewhere about £400,000), and the net annual return is about 14s. 6d. per acre, which is somewhat low.

XIII. The area of the forests of Switzerland is only vaguely known, since they have not yet been fully mapped. From such information as is available it appears that some 2,320,000 acres are wooded, which is 22·7 per cent. of the whole country. Of course the Alps comprise an enormous area of unproductive ground. The Jura is the most thickly wooded part. The spruce accounts for 40 per cent. of the forests, the silver fir 20 per cent., the beech 25 per cent., and various species 15 per cent. The Government forests are much less extensive than those of communes, while the area privately owned is small. The forests are divided into "Forests of protection," and "Free forests." The former must be worked under Government orders, and the Government grants large subsidies in connection with them.

Whereas 25 years ago the forest area was more than sufficient for the population, now it is quite insufficient.

Switzerland has not long taken up forestry seriously. The State started a chair of forestry in the middle of the nineteenth century, but even now the course of instruction seems only to be of seven months' duration. Previously such foresters as there were studied in Germany, especially at Tharandt. Naturally, therefore, the earlier tendencies were German. M. Barbey, who writes on this matter, considers that the results have not been good, though one imagines that the German teaching can hardly have been altogether to blame. Apparently, while in theory the method was that of "Successive fellings" with natural regeneration, in fact it has been "Clear felling" not properly followed by natural regeneration. Thinnings, too, including the important "preparatory thinning" required for the formation of good seed-bearers, were omitted. Under the influence of Gayer, Boppe and Gurnaud there has sprung up during the last two decades a tendency to believe more in "Selection," though, if the author has been correctly understood, a Selection leaning towards the "Group" method. We might add that this tendency is not confined to Switzerland.

XIV. The wooded area of Russia (including Siberia) is said to be 2,119,440 square miles. Sixty-five per cent. of the European area belongs to the Crown, the same proportion in the Caucasus, and 75 per cent. in Asia. Thirty-four per cent. of European Russia is forest, the figures in the Caucasus and Finland being, respectively, 22 per cent. and 45 per cent. The most wooded part is the Government of Vologda, where forest occupies 83 per cent. of the country. The Government forest revenue is rising fast, but much less than the annual "possibility" is—according to the Forest Department—yet utilised, in default of means of communication. This is different to what one imagined. The revenue was, in 1905, 141,000,000 francs, and it has risen regularly to 235,000,000 francs in 1912. Taking the pound roughly at 25 francs, this is £9,400,000. But the expenditure is also rising fast. Twenty years ago it was 24,000,000 francs, whereas in 1913 the budget estimate was 92,200,000 francs (say £3,690,000. There are two forest schools, one at Petrograd and one in Poland. The *personnel* of the Forest Department appears to consist of 1400 superior officers, 3022 assistants, and 32,000 subordinates. There is an immense amount of work to

do, but that they are doing it is shown by the fact that they have no less than 800 officers engaged on working-plans. It was stated above that the Government forests, which comprise the greater part of the wooded area, were not being worked to their full yield, and that the revenue in 1912 was some £9,400,000—but the figures of the commerce in Russian wood are so large that it would seem that the forests of other proprietors must be being cut extremely hard, if the facts are correctly reported. The figures sound incredible, but are given as follows. The value of wood exports are upwards of £25,720,000, but this is nothing to the internal consumption, which is said to be over £48,000,000. England is the principal outside client, taking 40 per cent. of the exported material, while Germany takes 33 per cent. (1911).

XV. We may see what useful results can be attained by a Forestry Association, from the case of Denmark. The country was originally well covered with forest, but in comparatively modern times was so much deforested that 50 years ago there were 1,821,625 acres of sandy waste or marsh—utterly unfertile, peaty at the surface and impermeable below—apparently hopeless. A certain Colonel Dalgas started a reclamation society in 1866, a part of the work of which is afforestation. It has a journal and nurseries for cheap plants, assists financially persons who undertake reclamation, and—what is especially interesting—has created a property of its own, to act as a field for experiment and as a model. The State gives it an annual subvention, which has grown year by year, till in 1912 it amounted to 690,000 francs. The property just mentioned is now 16,700 acres in extent, mostly wooded. Thanks to the society the original 1,821,625 acres of waste had in 1913 decreased to 691,600 acres. The climate has been appreciably modified. The mean annual rainfall of Jutland was 636 millimetres during the period 1878-1900, whereas for the period 1901-1911 it was 685 millimetres. The society has brought about the afforestation of 118,740 acres, for which purpose (principally) the 2100 owners have received over 15 million plants. Such of the owners as submit their woods to the treatment prescribed by the society, receive from Government, through the society, a third part of the cost of planting. The figure comes to 97,000 francs a year. The principal species used are the silver fir, mountain pine and spruce. From which, as in the case of Norway, mentioned in last year's *Transactions*,

it will be seen that foreign countries take forestry very seriously, and find satisfactory means of assisting it.

One wonders if the experiment mentioned above, of a society starting its own forest domain, is satisfactory. There is much that might be said for it. It would have plenty of science and zeal behind it, and—an especially important point—the proprietor would be a practically imperishable one, while the method of treatment should provide a useful model, not only for members of the society, but for all. *But* who would form the executive? It could only, perhaps, be a committee formed by the council, and it is to be feared that there might be disagreements, since doctors disagree often enough, and more especially forest doctors, while, since the executive committee could not be permanent, there would not be the necessary continuity in policy. On the whole it seems doubtfully feasible, but this is a pity, for the idea is a fascinating one. If a forest society would find difficulties in the way of working a forest domain of its own, there is at least one matter, of a cognate nature, for which a society would be a specially suitable body, viz., the formation of a Research Bureau, for the investigations of which some small areas of woodland might advantageously be maintained.

9. Proposed Scheme for the Afforestation of the Camps Catchment Area, Middle Ward, Lanarkshire.

By G. P. Gordon, B.Sc.

In essence the scheme comprises the economic afforestation of certain of the lands on the water-catchment areas of Camps and Glengavel, in addition to the formation of a large permanent forest nursery at Hairmyres. The area over which it will operate consists approximately of some 6000 acres, but this extent is dependent upon whether certain additional lands can be acquired. As regards the feasibility of the undertaking, it may be pointed out that the areas are particularly well suited to produce profitable timber crops. The conditions of soil and climate are such as to make possible the production of first-class quality timber of certain coniferous species. The elevation, though generally speaking high, will have no injurious influence upon tree-growth, since the plantable ground is very well sheltered by

high ridges. Indeed, the forests when established will be particularly free from the more important dangers in the form of wind, fire, frost, snow, etc. As regards the future marketing of produce, the areas have special advantages since they are easily accessible by roads and railways to large centres of consumption. An important factor which will make for the success of the scheme is the fact that the lands in question are entirely the property of the Local Authority. This condition of affairs will render possible continuity of management; in addition there will be freedom from any disturbing influences, so that the necessity for departing from the provisions of the working-plan as sanctioned by the Development Commissioners will not arise.

The main objects of the scheme are as follows:—

1. The conservation and maintenance of the purity of the water supplies on the respective areas.
2. The production of timber suitable for the extensive local markets of the Lanarkshire coal-field and the city of Glasgow.
3. The provision of healthy and interesting rural employment, on lines which local economic conditions will determine.

It will be the aim of the working-plan to provide for these objects with the least possible disturbance of the existing industries of sheep grazing and shooting, and to employ a maximum of labour.

Management.—In view of the comprehensive nature of the scheme, all land except that within the reservoir fences must be under the direct control of a forest officer, who will be personally responsible for it to the District Committee. The forest authority can then arrange for the letting of grazings and shootings to such an extent and in such a way that the interests of forestry do not suffer.

It is imperative for the forest authority to have absolute control of all game, vermin and fishing. Such being the case the working-plan need not provide for rabbit-netting, as the rabbits will be kept down by trappers, and in this way the initial cost of formation will be materially reduced.

The administration of land under forest will be detailed in the working-plan, and will be based on purely silvicultural

principles. The objects of management are to produce the greatest net income from wood and timber compatible with fulfilling the other indirect objects of the scheme. No consideration, therefore, for sporting interests or for amenity should influence the Forest Policy.

Generally speaking, the provisions of the working-plan will hold good for a period of at least five years, after which time they should be revised.

Planting Plan.—The topographical features of the areas determine in the main the provisions of the planting plan. These features consist on each area of two main valleys, from which numerous lateral valleys emanate. The complex of valleys is in each case completely encircled by high ridges or plateaux rising in some cases to 2000 feet. In the valleys there is at present a considerable amount of erosion going on, including the breaking away of peat, particularly towards the head waters of the side streams. The immediate effect of this will be to silt up the reservoir and to render the water supply impure. In the course of a few years, by planting up these valleys, this will be rectified, and a more constant supply of water from springs will be assured. It is proposed, therefore, to establish as quickly as possible a belt of forest on the lands which are contiguous to the water both in the reservoir and in the streams.

The direct result of this will be to absorb a certain amount of "wintering," but when the scheme has been established, with the enclosing of each block of wintering ground there will be a corresponding block of forest thrown open. This ground will have a greater wintering value than formerly because of the shelter afforded by the forest. Generally speaking, the planting plan applies at present only to land below the 1500-feet contour line. A considerable area of land at higher elevations can thus be permanently reserved for grazing and shooting.

The markets and the locality determine largely the species of trees employed for planting. These will comprise mainly spruce (Norway and Sitka), larch (European and Japanese), and Scots pine. The proposed arrangement of these species is as follows:—Spruce (Norway), on the low flats; larch, on the lower hill slopes and in the high side valleys; spruce (Sitka), on the upper slopes and on peaty areas; Scots pine, on the most

exposed parts. The intention is to raise all plants in the nursery at Hairmyres, which will ensure a supply of healthy plants, and will greatly reduce the cost of planting. The seedlings, after remaining two years in the seed-beds at Hairmyres, will be transplanted for one year into temporary nurseries at Camps and Glengavel.

Hairmyres.—An excellent site for a large permanent nursery has been selected at Hairmyres. This comprises a field of some 9 acres in extent, which as regards soil, subsoil, exposure and climate has everything in its favour. A part of the area will be utilised to establish a shelter-belt of broad-leaved trees round it, while the greater portion will be used for nursery purposes.

In addition to the raising of plants, the nursery has two other important functions to fulfil. In the first place, it provides interesting and easy employment for a large number of selected patients,[1] who will be occupied in trenching, weeding, hoeing, sowing, and transplanting. Secondly, it forms a practical training centre for such patients as intend making forestry their occupation in the future.

The areas of Camps and Glengavel will be supplied with plants entirely from the Hairmyres nursery. In addition, a certain number of ornamental trees and shrubs will also be raised for use in the grounds and gardens at Hairmyres or elsewhere. The area required for the tree nursery is approximately seven acres, the remainder of the land being taken up with shelter-belts.

Camps and Glengavel.—The general planting plan will commence in each case at the reservoirs and large streams, after which operations will proceed up the lateral valleys. As a preliminary to planting the land will be fenced off in sections,

[1] In connection with the tuberculosis scheme at the Middle Ward of Lanarkshire, the District Committee propose to establish a special sanatorium at Hairmyres, which is intended for two classes of patients—(1) selected adult cases which have shown such improvement that further treatment of a special character is desirable, and (2) children. As regards (1) adult cases which have made satisfactory progress in the various sanatoria; that is to say, cases which have undergone a period of "habit and health training," whose condition has improved to such an extent that further and advanced treatment is essential, and who themselves are desirous of following out a further course, will be transferred to Hairmyres and will there undergo a special course of training and tuition which will embrace work on the land, market gardening, poultry and pig rearing, and the early stages of forestry work.

which will be drained and cleared of any rank herbage. At this stage also the alignment of prospective forest roads will be carried out, in addition to the laying out of compartment lines, also lines of "severance," etc. Planting operations will probably extend from early autumn until the following spring. The formation of each compartment will be followed successively by the operations of "beating up," cleaning, thinning, etc. In this way an ever-increasing demand for labour will arise, which it is hoped may be supplied from the training centre at Hairmyres.

Training and employment.—The training will commence in the nursery at Hairmyres, which should be in charge of a young, energetic foreman, who must have received a theoretical, as well as a practical, training. This foreman would also have complete charge of the afforestation at Glengavel. The nursery staff will consist of certain selected patients, who intend making a profession of forestry. By arrangement with the Forestry Department of the West of Scotland Agricultural College, continuous lecture courses in forestry will be conducted at Hairmyres, examinations held, and certificates awarded.

When the period of training is concluded at Hairmyres, it is intended to draft the men on to the Camps area, where they will serve their apprenticeship. It will, therefore, be necessary to have at Camps a foreman fully qualified in forestry. Under his charge the men will remain for two or three years, during which time their theoretical training will continue through the medium of demonstrations and excursions. On the completion of their apprenticeship the men will be able to take up appointments as foresters elsewhere. In this connection, through the agency of the Forestry Department of the West of Scotland College of Agriculture, many foreign appointments may be obtained, which would be highly advantageous for such men as were willing to go abroad.

It is impossible, at this stage, to state accurately the amount of employment which will be given by the scheme, but an approximate estimate has been made, which may give a general indication. It has been calculated that when the scheme commences the staff for Hairmyres and Glengavel would be as follows:—1 foreman, 10 men and 8 boys, or their equivalent. A separate staff for Camps would consist of 1 foreman and 6 men, with boys from the nursery for planting, making in all a

total of 18 men and 8 boys. This staff would suffice only for the first two or three years, after which it would be added to each year.

The District Committee, I understand, are prepared to allow the area at Camps to be made available for purposes of research, education and demonstration, and desire that it should be associated with the West of Scotland Agricultural College. The value of this for educational purposes cannot be over-estimated, as the area is very convenient and is specially well adapted for demonstration purposes.

Financial aspect.—In this connection there are certain indirect benefits derivable from the scheme, which, although they have no influence upon any financial statement, should not be lost sight of when considering this question. This would apply specially to the enhanced value of the water supply, and to the curative and educational values of the scheme to tuberculous patients.

At the outset the most important financial considerations, perhaps, are the terms of the loans offered by the Development Commissioners, but the District Committee are fully aware of the general terms and conditions on which such loans are granted, and it is not necessary, therefore, to refer to them.

It would be misleading at this stage to make any generalisation *re* the cost of formation per acre, since it must differ considerably on different parts of the area, but the following average figures are given in order that a general idea of the cost may be obtained :—

Draining and soil preparation, say	£0	13s.	per acre.
Cost of plants . . .	1	10s.	,,
Cost of planting . . .	1	10s.	,,
Cost of fencing . . .		10s.	,,
"Beating up" . . .		10s.	,,
Upkeep of fence . .		2s.	,,
Trapping rabbits . .		1s.	,,
Rates, taxes and management		4s.	,,

This gives a total of £5 per acre.

The greater portion of this is seen to consist of initial outlay in formation which is covered by the loans. The part of the expenditure which recurs annually comprises only the cost of maintenance, rates, taxes, etc.

The productive period already referred to commences, in the

case of larch, at or before the 20th year, when from £5 to £10 or more may be realised per acre for thinnings. At a later stage the larch woods may yield 2s. or more per acre, per annum, for grazing. As regards final returns no approximation even can be made, but the following will show that in the West of Scotland certain species yield large returns on a comparatively short rotation. The example is that of a larch plantation on rough grazing land.[1] "The hillside has a north aspect, and is exceptionally favourably situated close to a sea-loch with easy and very exceptionally cheap transport by ship to the Clyde. The wood was felled at forty-one years of age, and gave 380 trees per acre, with the following financial result":—

Income.

943 cub. ft. sold at 1s. 3d.				£58	18 3
85 ,, for home use at 1s.				4	5 0
7188 lin. ft. 5 ins. pitwood at 32s. od. per cent.				115	0 0
1638 ,, 4 ,,	19s. 6d.	,,		15	19 3½
1200 ,, 4 ,,	18s. od.	,,		10	16 0
4188 ,, 3 ,,	8s. 9d.	,,		18	6 4½
	Total			£223	4 11

Expenditure.

Felling, logging, and carting		£32	13 6
Freight and lighters: and railway charges on 102 tons		26	14 2
	Total	£59	7 8
Giving a *net income* per acre of		£163	17 3

In order to obtain data which will be of great value not only in the future development of this area but in drafting similar schemes for other areas in the West of Scotland, accurate accounts of all details of income and expenditure should be kept and be made available for purposes of research.

I am engaged at present preparing the working-plan showing in detail the whole proposals. My survey and examination of the

[1] See *Afforestation in Scotland*, by Lord Lovat, and Captain Stirling of Keir, 1911, pp. 74, 75.

areas, however, being completed, I am in a position to say that every assurance can be given of a successful and profitable scheme being wrought out, and that the District Committee need have no hesitation in proceeding with the same. I consider the proposed scheme, taken as a whole, to be outstanding in that :—

1. It will fulfil a national purpose.
2. It will be of material assistance to the Water Undertaking.
3. It will be financially profitable in due course.
4. It will provide a new and practical feature in connection with the treatment of tuberculosis, affording healthy and suitable employment and the requisite training in forestry work to enable many to earn their livelihood in this industry in future years.
5. It will foster and assist forestry in the West of Scotland by creating excellent demonstration areas within easy reach of the teaching centre of the West of Scotland.

10. The Present Condition of Forestry in Italy.[1]

By Prof. Lodovico Piccioli,
Forest Inspector at Catanzaro (Calabria).

In order to give an idea of the condition of our forest wealth, and of the difficulties which are encountered in framing a single code of forest legislation without prejudice to the interests and customs of the population, it is sufficient to review rapidly the uncertain and desultory evolution of the laws in their hydraulic, economic, hygienic and pastoral aspects.

Between 1860 and 1877 every region of Italy had its own forest laws. In what had been the kingdom of Naples on the mainland, the law of Francis I., of 21st August 1826, which was extended to Sicily by the decree of 26th March 1827, was still in vigour. It was perhaps wiser than the others, and it might have been extended to the whole peninsula with advantage to the forest economics of the country. In Tuscany, after the edict of Peter Leopold, dated 24th October 1780, the greatest liberty prevailed. Piedmont obeyed the letters patent of Charles Albert, dated 1st December 1833, and 28th January 1834, and

[1] Reprinted from the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, iv., No. 2.

Sardinia those of 14th September 1844, and the decree of Victor Emmanuel II. of 4th November 1851, which was later extended to the Marches and Umbria. In Venetia and in Lombardy the decree of Eugene Napoleon, of 27th May 1811, was still in force.

The Hon. Majorana Calatabiano attempted to remedy this want of uniformity in the legislation by means of the law of 20th June 1877, which is still fundamental in Italy. It is very liberal, being based on the opinion that in order to promote forestry free competition is more advantageous than monopolies and servitudes, and that when the demand is greater than the supply there would be no lack of landowners who would be induced by the prospect of profit to grow timber. In this law liberty is thus the rule and servitude the exception, the latter being limited to those cases bearing upon water-courses, upon the protection of the land against erosion, etc., and upon public health, but without any consideration of economic, climatic or æsthetic factors. There was no provision for rendering re-afforestation compulsory.

This law ushered in a great destruction of forests. Whilst the area of forests under the surveillance of the administration was 12,463,543 acres on 1st January 1877, it was reduced to 7,402,395 acres on 30th June 1879, and by successive freeing from servitudes to 7,251,130 acres on 1st January 1900.

Too much trust was placed in the good effects of liberty, and not enough consideration was given to the often imperious motives which induce landowners to fell their forests, and to the difficulty of finding people willing to embark their capital in afforestation schemes, trusting to the market conditions of a century later. Subsequent events proved that only a portion of these woods was destroyed with the object of transforming the soil they occupied into fields, meadows and vineyards, and thus increasing the wealth of the country. The greater part of the forests were ruined by the excessive fellings to which the owners were driven by their straitened financial position, and by the demands of the market. Concomitant causes were the haphazard grazing and the primitive manner in which farming was carried out upon the cleared lands; usually after a few years they were abandoned to the action of the water, which leached them out and carried away the vegetable soil which had accumulated in the course of centuries.

It is believed that upwards of one-third of the forests freed from servitudes have already been ruined, and that another third is deteriorating so that before long it also will disappear. Some instances taken from official publications will give an idea of this work of destruction: In the Sila (Calabria) 77,341 acres of land freed from forest servitude were broken up and sown with rye, flax and potatoes, *the timber being burnt on the spot as it could not be sold.* In the province of Sassari (Sardinia), 407,550 acres of high-forest and coppice were freed from forest servitude, and the owners were left absolutely free to do what they liked with them. They paid no attention to either the preservation or the regeneration of the forests, because after the trees were felled unrestricted destructive grazing of all kinds of animals was allowed.

That the measures concerning the freeing of forest servitudes were very injurious, and that the list of such abrogations were hastily drawn up, besides being full of errors and not sufficiently controlled, is proved by the fact that in many cases it has been found necessary to propose the reimposition of the servitude, and that in general, and especially along the Apennines and in Sardinia, many of the freed belts have become bare stony slopes, rocky precipices, or steep clay banks burnt up by the sun, which seem to baffle every attempt to render them fertile or clothe them with forests by economical methods. Liebig used to say that a population that allows the fertilising substances of its land to be carried into the sea during a century will be obliged to follow them and to emigrate; and Victor Hugo wrote: "*C'est la substance même du peuple qu'emporte, ici goutte à goutte, là à flots, le misérable vomissement de nos fleuves dans la mer.*"[1] This indeed has happened on the slopes of the Southern Apennines, where a part of the mischief is no doubt due to geological causes beyond the control of man; but by far the greater part of it is the effect of the wastefulness and neglect of man, who has paid no heed to the equilibrium of natural forces, and has not considered the far-reaching effects of his actions.

There were not wanting scientists and parliamentary men who attempted to stay this continued work of destruction. But failure attended every effort to introduce a real forest law

[1] It is the very substance of the people which is being carried away, here drop by drop, there in floods, by the torrential discharge of our rivers into the sea.

providing for the conservation and improvement of existing forests, for the afforestation and putting to grass of those lands that cannot be kept permanently under more profitable crops, for the extension of wooded pastures, for the conciliation of the interests of silviculture and animal husbandry to the advantage of the inhabitants of the mountains, and lastly for means of prohibiting large landowners, neglectful of their social duties, from allowing immense tracts of land go to ruin.

The law of 1st March 1888, on re-afforestation, the regulations for the application of which were not even published, had such meagre results that it may be considered a dead letter.

From the official statistics, it appears that between 1867 and 31st December 1904, the area re-afforested, at the expense of the Government or with its assistance, amounted to 129,302 acres with an outlay of £131,885. Thus in 38 years the area re-afforested is 27 times smaller than that freed from servitude in the second half-year of 1877. It seemed as if an adverse destiny weighed on Italian forests, and even after some disastrous inundations the remonstrances in the Chamber of Deputies failed to obtain a satisfactory solution of the forest question.

Guido Baccelli, who in spite of the ridicule of his adversaries had founded experimental school gardens and instituted an Arbor Day, has the merit of having succeeded in putting through the first bill (that of 29th December 1901) affirming the æsthetic importance of forests; this bill further set aside as health resorts the celebrated forests of Vallombrosa, Camaldoli and Boscolungo in the Tuscan Apennines, the Cansiglio forest in the province of Belluno, and the Ficuzza forest in the province of Palermo. Baccelli also had the courage to present a bill, on 26th April 1902, subjecting to servitude every wood in the kingdom whatever its position; but this was doomed to failure, and after having been approved by the Senate it was buried in the offices of the Chamber, notwithstanding that it contained the germs of that new feeling for forests which was so soon to bear fruit and to usher in the period of the restoration of woods. Thus, on 26th June, the measures for the protection of forests in the Sele catchment basin were approved. This step, for the first time in Italian legislation, affirmed the principle admitted by the Romans that forests supply the courses of rivers and regulate their course.

On 31st March 1904, the law applicable to Basilicata came into force; in imposing the forest servitude this recognises, besides the interests of hydraulic and hygienic interests, the economic factor also. It provides for exemption from land tax in favour of those who re-afforest, and grants them prizes; and it authorises an outlay of £856,400 for the regularisation of the water-courses in the plain and in the mountains, including the work of re-afforestation and of strengthening the slopes.

The law of 25th June 1906, applicable to Calabria, confirms the exemptions from land tax and the giving of prizes to those who re-afforest, and votes £935,700 for the regularisation of the water-courses in the plain and in the mountains, £352,000 for drainage, and £137,400 for consolidating slopes that threaten inhabited centres with landslips.

On 19th July of the same year a law relating to Vesuvius was passed; it authorises an outlay of £234,000 to repair the damage caused by the eruption and by the subsequent downpours, and to provide for the regularisation of the water-courses and woods, besides a further £80,000 for similar regularisation on the southern slopes of Vesuvius.

On 5th May 1907, a law providing a Water Board for the provinces of Venetia and of Mantua was passed. This provides one administrative office for the control of the public waters in the provinces of Venetia, Padua, Treviso, Vicenza, Verona, Rovigo, Udine, Belluno and in that portion of the province of Mantua lying between the Po and the Mincio; this law is the beginning of a wise decentralisation in the management of waters and forests.

On 10th November 1907, the measures for Sardinia were approved; and on 5th April 1908, a sum of £8000 was voted to assist the work of improving the pastures, preference being given to those belonging to communes and associations.

On 2nd June 1910, Luzzatti's law was passed for the constitution of a vast State forest domain and for the protection and encouragement of silviculture; and on 22nd December of the same year another law on the works to be carried out on the waters and forests of mountain basins was approved. It allows for an outlay of £198,000 in the first five years, and £793,000 in the next fifteen years. On 13th July 1911, another law on mountain basins, water control and drainage was approved.

The last statistics published (on 31st December 1907) refer to

the forests subject to forest servitude. The figures are reported in the agricultural land book (catasto) of 1910, together with the area of woods not subject to forest servitude; these (including chestnut woods) are given in the following table:—

	Under Forest Servitude	Free from Servitude	Total
	Acres	Acres	Acres
High-Forest . .	3,840,850	1,449,186	5,290,036
Coppice . . .	3,512,340	2,470,000	5,982,340

The total wooded area from 1870 to 1910 was as follows:—

In 1870, according to Maestri	In 1894, according to the *Annuario Statistico*	In 1902, according to Stringher	In 1910, according to the Agricultural Land Register
Acres	Acres	Acres	Acres
12,430,624	11,132,854	9,666,943	11,277,396

The above figure for 1910 is 17·03 per cent. of the area of the country.

The values of the imports and exports of forest produce and of forest industry during the last eleven years have been as follows:—

Year	Imports	Exports
	£	£
1900	2,455,342	387,613
1901	2,557,237	412,301
1902	2,565,494	439,561
1903	2,718,190	472,271
1904	2,072,481	409,650
1905	2,202,599	300,252
1906	3,983,540	284,704
1907	4,734,132	287,440
1908	5,474,484	319,239
1909	9,355,083	237,205
1910	6,300,728	267,013

There are no precise data as to the yearly production of timber, but an approximation is given by the following table based on the calculation that an area of high-forest yields 36 cubic feet of wood, an acre of coppice 43 cubic feet, and the 29 million acres of fields, wooded pastures, brushwood and hedges yield 7 cubic feet per acre.

PRODUCTION OF TIMBER, IN CUBIC FEET.

From High-Forest	From Coppice	From the Fields	Total
189,097,566	256,613,000	212,000,000	657,700.000

The insufficiency of normal production has been hitherto met by excessive felling, which has encroached upon the capital of timber, and by importation, which increases to an alarming extent.

The law on the forest domain has considered the difficult problem of the restoration of forests with great breadth of view, and has attempted to remedy the fundamental defect of the present servitude, which on the bare lands ends by causing much harm. It is injurious inasmuch as it forbids the breaking up of the land to convert it into fields and meadows, which would often protect the soil exposed to erosion and washing away by torrential rains: further, as it is not concerned with the positive duty of re-afforesting and of consolidating slopes liable to landslides, it is an encouragement to inertia. The law on the forest domain considers the problem from the standpoint of public utility, not only as connected with the hydraulic, hygienic and economic aspects, but also with the æsthetic and historical ones. Due attention is also paid to those forests which provide the only work available to the inhabitants of mountain communes. But it was not enough to provide for the defence of the soil by the improvement of the water-courses and of the forests; it was necessary also to increase our forest domain, by creating large extents of forest sufficient to meet the future penury of timber from which our country will certainly suffer. Thus betimes the administration will purchase bare lands suitable for profitable afforestation, and badly managed woods, taking the place of private ownership which can ill afford to wait a long time for returns. The administration will also exert the necessary pressure on corporations and private owners by setting an example of good management, and will also assist them by means of active propaganda, advice, technical direction, prizes, and exemptions from taxation calculated to render forestry in the mountains more profitable and consequently preferable to other forms of exploitation. The forest officials should become

the natural protectors and advisers of those engaged in forest industries; they must make a radical change in their tactics, which can no longer consist in perpetually threatening penalties against the destroyers of forests, as this system has proved ineffectual for the maintenance of existing forests.

For the execution of this vast programme, which includes also the reform of education in forestry, considerable sums have been voted; for the first five years (1st July 1910 to 30th June 1915) these will vary between £1,150,000 and £1,300,000, according to the eventual surplus in the general budget of the State.

After the first trial of five years, and after considering the results obtained during that time, a future yearly vote will be established. A rather optimistic estimate, compiled in 1910 by the Central Inspectorship of Forests for the General Budget Committee, suggested the possibility for the State of ensuring, by means of an outlay of £6,185,000 to be spent in twenty-five years, a forest domain which in its seventy-fifth year would be worth almost 60 millions.

Other provisions apparently less important, but of great practical value for those who know the useful conservatism and the injurious passive resistance of bureaucracy, are those concerning the establishment of a purely technical general direction relatively independent, distinct from the water, drainage, domain and easement services and from territorial divisions, and resembling the Water Board of Venice and the chief inspection offices of the civil engineering service.

This law, the result of much study, has a clear vision of the best way of attaining its object, and is the greatest parliamentary achievement in forest matters since the union of the kingdom.

Forest legislation has progressed considerably since 1902, and almost every year it has been increased by a new law. Now, rather than by the enactment of new laws which would risk plunging us into the same chaos that existed before 1877, and keeping us in the midst of proposals instead of facts, it would be desirable to solve the forest question by means of the existing laws, applying them firmly and perseveringly. If there is one measure necessary to restore to the mountains their wealth of water and forests, it is the tranquil constancy of direction which will enable the owners of forests to proceed quietly and continuously in their work, like Nature herself.

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11. Extra-Tropical Forestry in Portugal.[1]

By D. E. HUTCHINS.

Extra-tropical forestry in Southern Spain and Portugal has a peculiar interest for southern extra-tropical Australia, because the climate, the trees, and the forestry of both countries are (or will be) very similar. Australia is now paying out about £3,000,000 yearly for imported soft wood; and to produce this at home in the future (judging from the experiences of South Africa) Australia will have mainly to copy the forestry of Southern Europe. The writer, after a life-time in South African forestry, has recently completed a forest tour in Southern Spain and Portugal. The chief points of interest for this country are these:—

The most important forest tree, and the only abundant forest

[1] Abstract of a paper read by Mr D. E. Hutchins before the Botanical Section of the British Association in Australia.

species in Portugal, is the Cluster Pine (*Pinus pinaster*), the same tree which (under the name of the Maritime Pine) has transformed the dreary malaria-stricken "Landes" of Southern France. It is the Cluster Pine also which, on its own merits, has become the most abundant coniferous tree in South Africa. The Cluster Pine and the Stone Pine were introduced into South Africa some three hundred years ago, and have now become completely naturalised there, in the sense that they have taken the place of the weak natural forest flora of the country, and would remain there if the hand of man were withdrawn.

In the centre of a large pine forest area in Portugal is the State forest of Leiría, comprising over thirty thousand acres. It has long been worked for timber of large dimensions, and is perhaps the best example of *a highly cultivated pine forest* in the extra-tropics. The temperature here is between that of Sydney and Melbourne; the rainfall is similar except that it falls almost entirely in winter. Timber of the finest description is seen in the Leiría forest, as fine as any timber in the best forest of Central and Northern Europe. I measured trees up to 35 inches diameter and 158 feet total height, and I saw great baulks of timber being taken out of the forest, such as one sees in the Black Forest of Germany. One usually associates Cluster Pine with pit-props, sleepers, and small timber; but the State forest of Leiría produces pine timber which is used *for every purpose of house-building and furniture*. To protect the forest from fire during the dry summer weather, there is a complete system of fire-paths, watch-towers and telephones. The area of private Cluster Pine forest in Portugal is very large. This is mainly occupied in providing mine-props for England. Not much resin is produced in either State or private forest in Portugal.

Cork Oak (*Quercus suber*).—After the Cluster Pine the next most valuable forest tree in Portugal is the Cork Oak. The Cluster Pine and the Cork Oak together enable Portugal to export about £1,250,000 worth of forest produce yearly.

Busaco Cedar (*Cupressus lusitanica*) has been naturalised in Portugal about as long as the two pines in South Africa. My friend, Dr Henry, has shown that it came originally from Mexico; it now produces the most valuable timber in the natural forests of Portugal. It should occupy a prominent place in any scheme of extra-tropical forestry. It is a most beautiful and valuable tree.

Stone Pine (*Pinus pinea*).—This useful pine with its valuable nuts has suffered badly in South Africa from a fungoid disease; but in Spain and Portugal it is nearly free from it.

Aleppo Pine (*Pinus halepensis*).—This has certain advantages over Cluster Pine. It stands more drought; it will put up with lime in the soil; it transplants more easily; it is somewhat more shade-bearing. It is the species used for re-foresting the devastated mountains of Southern Spain.

Oaks.—Five oaks occur in Southern Portugal. The common British oak (*Quercus pedunculata*) occurs as copse and scattered trees on good soil. Portugal pays heavily for cooperage wood, and wants a great deal more oak.

Quercus lusitanica may almost be regarded as the extra-tropical form of the British oak. It should occupy an important part in the future forestry of Australia. It has been nearly exterminated in Portugal precisely on account of its valuable qualities.

Quercus tozza somewhat resembles the Durmast Oak of England; it is not often seen as a large tree, but makes valuable firewood copse.

Quercus ilex.—The forest tree-planter in Australia and South Africa will generally prefer its first cousin, the Cork Oak; but the ilex is somewhat hardier than the Cork Oak. It is the last tree left on the mountains in Southern Spain and Portugal, where fires and the axes and goats of the peasants have produced universal desolation. Its chief value lies in acorns for pig-feeding, and there is a variety termed *Ballota* which produces acorns nearly as sweet as a chestnut.

Chestnut (*Castania vesca*) seems steadily dying out in Spain and Portugal, as in other Mediterranean countries. The threatened loss of this valuable tree is one of the saddest features in modern European forestry. It may take a new lease of life in the southern hemisphere, care being of course taken (as with eucalyptus in South Africa) to import the tree without its pests.

The Portuguese forest service is well organised, and the department generally far in advance of Britain and the self-governing British Colonies, except South Africa. It used to be customary in the forest text-books to place Spain, Portugal, and the British Empire at the bottom of the list as regards effective State forestry. But forestry in Spain and Portugal is now a quarter of a century ahead of that of the British Isles; and many valuable

lessons are to be learnt by those who can go to Spain and Portugal for the purpose of studying forestry. Portugal imports one-third million pounds' worth (against three millions, Australia, and thirty millions, Britain) of forest products which, with good forestry, would come from the waste lands of each of these three countries. Portugal exports about one and a quarter million pounds' worth of forest products—cork, one million; Cluster Pine pit-props, etc., one-quarter million—against Australia, one million, and Britain nothing (the figures shown being re-exportations). Portugal and Australia have each a population of over four millions.

12. Classification of Moorland at Fersit for Purposes of Planting.

(*With Plate.*)

By Donald Grant.

In vol. xxviii. p. 72 of the *Transactions* I dealt with planting on "deep peat," or what is called "flow moss." It is now my purpose to describe the "shallow peat," or what is termed "hill moss." The "flow moss" is met with in hollows, at the foot of steep slopes, and on flat areas, and very often attains a depth of 10 feet. This kind of moss is classified according to colour, texture and depth; the herbage serves also as a valuable indicator of the most suitable species of tree to plant.

The first-class quality of this moss is very deep, is of fine texture, dark in colour, and easily cut. Large quantities of decayed birch stumps are found at a considerable depth below the surface, and sometimes quantities of Scots pine roots are met with, although the latter are found more abundantly in the third-class quality. On it grow flying bent (*Molinia cærulea*), bog myrtle (*Myrica gale*), orchids, devil's bit (*Scabiosa*), a little heather (*Calluna vulgaris*) and some dwarf willows. It is principally distinguished, however, by the large amount of flying bent which grows on it. This quality is best adapted for growing Sitka spruce (Plate VIII. Fig. 1) and Norway spruce. Scots pine and mountain pine also grow well, but very deep drainage, in the course of time, would be necessary owing to the length of the tap roots which they develop.

In the second-class quality of "flow moss" the peat does not attain a great average depth, seldom more than 18 inches,

although the maximum depth may exceed 3 feet. It is dark brown in colour, and more fibrous and compact than the first quality. On it grow a mixture of heather, bog myrtle, some sedges, and some deer grass (*Scirpus cæspitosus*), the heather being the dominant plant. This quality is also best adapted for spruce.

The third quality peat of the "flow moss" resembles the second-class quality in the appearance of the surface vegetation. It attains a depth of 8 feet, is brown in colour, and is of a much coarser texture than the first- and second-class qualities. Large numbers of Scots pine stumps, stems and branches are found embedded in it. It is covered with heather, deer grass, cotton grass (*Eriophorum vaginatum*), and species of *Carex*. This quality of peat is found to be unsuitable for growing spruce, and only Scots pine and mountain pine are successful in establishing themselves.

The fourth quality peat of the "flow moss" is invariably found at much higher altitudes. It covers a very large area of Corrour estate, and is quite unsuitable for planting. It is found to attain an average depth of 22 inches in the planted area, but, in the vicinity, it is often found to be over 11 feet deep. It is invariably of a dark brown colour, is very tough, fibrous and of a leathery consistency. The dominant plants which grow on it are the cotton grasses, from the decaying remains of which this kind of moss is largely produced, and there is also a large proportion of deer grass and some Carices. There is also a small proportion of heather, including the pink bell heather (*Erica tetralix*). Owing to its leathery consistency this peat is very difficult to cut, and, unlike the other classes of "flow moss," when upturned and exposed to the elements it does not readily decompose, not even after a period of four years. The roots of the spruce seem unable to penetrate this peat, and it is only with difficulty that even the Scots pine can grow on it.

The "Shallow Peat" or "Hill Moss."

The "shallow peat," which is termed "hill moss," differs in many respects from the "flow moss." It is always met with on knolls and steep slopes, or where the declivity of the ground, or the permeable nature of the subsoil, prevents the stagnation of moisture which is so necessary for the formation of the former. It is merely an incrustation of a few inches, and is seldom found to exceed 1 foot in depth. Draining in any shape or form is there-

FIG. 1. SITKA SPRUCE.
2-year 1-year, planted on first quality deep peat, April 1909. *Untreated.*

FIG. 2. EUROPEAN LARCH.
2-year-seedlings, dibbled on first quality "shallow" peat, in April 1910.

[*To face p.* 74.

fore out of the question. The area on which the plantations on "shallow peat" are established are within the boundaries of those described in my former article in the January issue. They form a strip varying from 200 yards to over 400 yards in width, and extend along the West Highland Railway from Fersit to Loch Treig. The elevation varies from 850 feet to 900 feet over the sea. The aspect varies from south-west to north. The land is very undulating, most of it occurring on a series of morainic mounds grouped together. Between these are a number of small lakes, some of which attain considerable size and depth, while others are but mere swamps with a slightly higher surface, and they too appear to have formed similar lakes at some earlier period. More recently they have become filled up by accumulations of decayed vegetable matter, the remains of mosses and other plants which grow in them.

The subsoil on the slopes is very gravelly, and water can percolate freely through it, but on the top of knolls, and along ridges, also at the foot of slopes, the gravel is mixed with clay which forms a fairly hard pan of a very retentive nature, and here the "hill moss" attains its greatest depth. For planting purposes the "hill moss" is divided into three classes.

The first class, or best quality, is met with on steep slopes and seldom exceeds 4 or 5 inches in depth. On it grow heather, sheep's fescue (*Festuca ovina*), devil's bit, species of orchids, and a small proportion of bracken. It is also characterised by the entire absence of the deer grass, heath rush (*Juncus squarrosus*), and the cotton grasses, which appear in the second and third classes. This quality of peat is always planted with larch, which proves most successful (Plate VIII. Fig. 2).

The second class, or next best quality, is dark in colour and much more fibrous than the first class, and attains a depth of 9 inches. It also contains much more moisture. On it grows a thick sole of heather, with some heath rush, deer grass, and a small sprinkling of *Eriophorum vaginatum*, and bog asphodel (*Narthecium ossifragum*). This quality of peat is better adapted for Scots pine than for larch. The former has been planted rather extensively on it, and grows strongly and well. Larch has also been planted on it, but during a period of four to six years it remained in a very unhealthy state, from which, however, it quickly recovered, apparently after the roots had penetrated the subsoil.

The third-class quality is somewhat similar to the second-class quality in the appearance of the herbage which grows on the surface. The peat is black and fibrous, and holds more moisture than the former. Strange to say, on the top of morainic mounds, it is often found attaining an average depth of 11 inches. The dominant plants which grow on it are heather and deer grass, both of which seem to be naturally adapted for growing on this class of peat. Sometimes, however, knolls with a strong growth of bog myrtle, mixed with flying bent, are met with. The thick sole of heather and deer grass, as well as the depth of peat, indicate that the underlying soil is not naturally well drained, and a pan is sometimes present. It is therefore quite inadvisable to plant larch on such areas; the Scots and mountain pines have proved the most suitable species. On the "hill moss" as distinct from the "flow moss" no spruce is planted, as when peat is present to any extent on the sides of the hills or knolls, it is usually of a coarse, fibrous texture, and the roots of spruce seem unable to penetrate it. The methods of planting "hill moss" are dibbling or notching, according to circumstances; the former being preferable wherever possible.

From the above classification it will be seen that the plants growing on the surface of the moor can serve as valuable indicators of the quality of the peat of which it is composed, and its suitability for the growth of certain species of trees. Both the first quality of "flow moss" and the first quality of "hill moss" are distinguished by the entire absence of deer grass and cotton grass, while the most inferior qualities of both may be distinguished by their presence.

On the best type of "flow moss" Sitka spruce has done best, and on the best type of "hill moss" larch does best. On the most inferior types of both "flow moss" and "hill moss," pines establish themselves best. The best time to plant both mosses is from March to May.

13. Japanese Larch.

By Prof. A. Henry.

With regard to Sir Hugh Shaw-Stewart's inquiries in the last issue of the *Transactions*, p. 270, concerning the Japanese larch in its native habitat, attention may be drawn to an article by Kumé in the *Transactions*, vol. xx. p. 28 (1907), which gave a yield-table compiled from some statistics of plantations of this species in Japan. It may be worth while also to quote some brief accounts of this tree by other observers.

Mayr states [1] that *Larix leptolepis* is found growing wild only on the volcanoes of the central part of Hondo, namely on Fuji, Ontake, Asama, Shiranesan, Norikura, etc. All these volcanic cones are made up of blocks of lava and sand, which have weathered into an extremely fertile soil, containing much lime in its composition. The upper forest zone on these mountains is constituted by the larch with birches, *Abies Veitchii*, *Tsuga diversifolia*, and *Picea hondoensis*. The foliage appears on the larch in the beginning of June, and falls off as early as the middle of August. *Larix leptolepis* is confined to this part of Japan, and does not occur wild, as has been erroneously reported, in either Yezo or Saghalien. The Japanese have, however, planted *Larix leptolepis* in places with a warmer climate, as in the zone of the chestnut, Aucuba, and evergreen Euonymus, on the Amagi mountains, where Mayr saw among broad-leaf trees a plantation about 75 years old, which was about to be felled as the stems had ceased to make any increment in volume. These trees showed all the defects of larch plantations in warm climates, being very branchy, the wood showing broad rings, wide sap and pale-coloured heartwood. They were on an average only 95 feet in height, and 20 inches in diameter at breast-height. This plantation, like those made in Europe, showed great development of wide-spreading horizontal branches, so that it is evident that only close planting, or mixture with shade-bearing trees, will enable the Japanese larch to clean its stem.

Shirasawa informed me that this species attained 120 feet in height and 2 to 3 feet in diameter in deep volcanic soil on these mountains, where deciduous broad-leaf trees could not be grown

[1] *Fremdländ. Wald-und-Parkbäume*, p. 306 (1906).

(on what he called first-class pine soil). Both Kumé and Shirasawa agree that *Larix leptolepis* often grows in pure stands, as on Mt. Fuji, where Shirasawa had seen areas, from which the spruce had been swept away by an avalanche, being covered at once by pure growth of the larch. It also occurs in mixture with the trees mentioned above as constituting the upper zone of the forest in the volcanic region of Central Japan.

A handbook, entitled *Forestry of Japan*, which was published in English by the Department of Agriculture at Tokyo in 1910, states that the natural forests of this larch are chiefly found on the slopes of Mt. Fuji and Mt. Asama, and in the Azumi county of Shinano province, a little also growing spontaneously on Mt. Nikko. The tree is said to "grow on the dry soil of volcanic strata, making a healthy growth in the sunshine." It is very probable, however, that the deep volcanic soil on which it thrives —covered with snow in winter and exposed to a humid atmosphere in summer, owing to the altitude—is in reality full of moisture. The annual rainfall at 3300 feet on Fuji is 100 to 120 inches, the precipitation being heavy in summer, while clear weather prevails in winter. The handbook states that as the larch succeeds on poor and desolate soil, the districts in which it is planted have been greatly extended in recent times. In the State forests, 12,410 *cho* of land were planted in 1898-1907 with *Larix leptolepis*, 43,610,449 seedlings being used, while the rotation adopted is 60 to 80 years. The seed is collected in the Saku district of Shinano province, and in the southern part of Hondo, and in various parts of Shikohu and Kyushu; the output in 1907 was 2200 *koku*, valued at over 41,100 *yen*. The planting of this species is now largely practised by private owners of land in Japan.

In Hayata's interesting and well-illustrated book on *The Vegetation of Mt. Fuji*, published in English at Tokyo in 1911, it is stated that the conifer belt on this mountain extends from 4000 to 8300 feet altitude. On the north side, at Yakihome, the larch predominates to such an extent that it ranges from 5000 to 7300 feet, appearing like an island in the evergreen coniferous belt. On the east side, at Subaskiri, the larch attains its most luxuriant growth and extends through all the tree regions. It is most abundant at 6000 feet, diminishing in quantity at lower altitudes, none occurring below 3000 feet as a rule. In this zone of 3000 to 7000 feet the larch is a fine tree, growing both in pure

stands and in mixture with the evergreen conifers. Above 7500 feet and extending up to 9500 feet on the south side, there is a remarkable dwarf forest of wind-swept larch, the stems being prostrate and clinging firmly to the ground. At 8500 feet these stunted larches are mixed with low shrubs of willow, alder and birch. Hayata gives a photograph of a pure stand of *Larix leptolepis* at 5000 feet elevation on the south flank of the mountain.

14. German Forest Notes.[1]

(*Continued from Vol. XXVII. p.* 222.)

By B. Ribbentrop, C.I.E.

Dr Albert, as may be remembered by the readers of the *Transactions*, recommended, as the result of his searching inquiries and experiments, a shallow preparation of sandy soils by means of hoe and spade and, under *normal conditions*, absolute rest for the lower strata. In regard to a deep ploughing up of the soil, he considered no preparation of the ground preferable to a wrong one. Dr Albert's analysis, the correctness of which is accepted by his critics, shows that in areas treated by the steam-plough the chemical and biological activity is slackest, water circulation least favourable, and the temperature the lowest.

This naturally brought the advocates of the steam-plough up in arms, but they accepted, without waiting for Albert's final report, his "Quieta non movere," as an unqualified condemnation of this method of soil preparation. Landesforstrath Quaet-Faslem, who for forty-six years has been connected with the afforestation of nearly 100,000 hectares of heatherlands in North-West Hanover, leads in the controversy. However, all he says is that the areas selected by Albert for his researches were not sufficiently typical, and that he misses all mention of the impenetrable layer of Ortstone,[2] or similar formation, underlying the surface soil. He maintains that both the depth to which the steam-ploughs work and the cost thereof have been taken at too high a figure in Dr Albert's report. For rational

[1] These *Notes* were unavoidably held over from the last issue owing to press of matter.—Hon. Ed. *Trans.*

[2] Ortstone or Ort soil (moorpan) is the name of the layer of soil bound together and hardened by particles washed down from the surface soil.

steam-plough culture it is now, he states, the rule that areas operated upon should lie fallow for a period including at least two winters, in order to restore the capillary activity of the soil. The sample plots of steam-plough operations examined by Dr Albert had not been treated in accordance with the most approved and now generally adopted method.

Dr Albert, in his final report on the researches he made in the course of several years in the Luneburger heather tracts, now explains that the conditions of the soil are abnormal over extensive areas, and that the use of the steam-plough is the only means of dealing with them.

The sandy soils of the heather tracts, the only ones which are still available for afforestation, are, he states, found in two entirely distinct varieties, which, in accordance with the characteristic colour of their upper layers, may suitably be designated as grey and brown heather sands. The former are clearly pronounced bleached-out soils, though varying considerably in depth and the amount of humus they contain. A stratum is almost invariably found below these bleached sands, bound together by particles of soil washed out of the surface layers. The colour of this stratum varies considerably from rust-red to a deep brown-black, and so does the intensity of adhesion amongst the different particles, from friable Ort soil to a solid Ortstone formation.

In diluvial sands such strata are found with great consistency about 30 cm. below the surface, though in alluvium the depth may be considerably larger. All that is known about the origin of this peculiar formation is that it is invariably found on a basis of a compact layer of waterworn stones, chiefly flint and quartz, the intervals between which filled with a schistose sand forming an impenetrable bar between the upper and lower parts of the soil. Such strata, though only about 10 cm., or rarely up to 15 cm. thick, must naturally interfere with the movement of water in the soil and encourage the deposit of sediments on its surface. The brown heather sands are, on the contrary, entirely normal; there are no signs of a bleaching process in the surface soil, the change towards the lower strata is gradual and uninterrupted by any such strata as underlie the Ort formation. These brown sand tracts have unquestionably been under heather for centuries, as long as the grey sands, but are to-day perfectly sound. This seems naturally to lead to the theory

that the grey sand formation and that of the brown sand, owe their difference to their geological origin. No doubt it can be argued that the difference at present found in the composition of the two varieties of sand may be due to the washing out of the grey sand, and that it is quite feasible that they were originally of the same quality. There is no proof to the contrary, but the theory does not explain the existence of the impenetrable stratum of stones and sand which seems to be the primary incentive to the Ortstone formation.

Borchgreve asserts that the whole heather area in North-West Germany was at one time covered by forest, and that the present conditions are due to their devastation by the human race. There are clear indications that this was the case, but it does not in any way affect the theory of a different geological origin of the two varieties of the sand formation, for whilst the grey sands were under forest cover the washing out and bleaching process was more or less somnolent, and only became destructively active when the shelter of the forest was removed.

It has, however, been generally recognised that it should be left to the geological survey to clear up these as yet speculative theories concerning bygone ages, and that it is the clear duty of the practical forester to deal only with present conditions. Now these conditions in the Luneburger heather tracts are normal in the regions of the brown sand, whereas in those of the grey sands they are quite abnormal.

Albert repudiates the idea that in the latter case he recommended the shallow preparation of the soil, which sooner or later would invariably lead to a total failure, or that he condemned the use of the steam-plough under such circumstances. As a matter of fact, in his final report he strenuously advocates the radical breaking up of the underlying pan, independently of the degree to which the Ort formation may have developed; such breaking up should include the whole area to be cultivated. This can only be effected by the steam-plough. The old steam-ploughs turned everything upside down and destroyed all adhesion among the various layers of soil. This, however, is almost avoided by the modern plough of improved construction, and the sooner all but the latest models are thrown on the scrap-heap the better. Though this deep rooting up of the soil is under existing conditions necessary and unavoidable, experience has shown that such ploughed up

areas must lie fallow for at least two years, in order to allow the soil to regain its balance and settle down. Wherever the heather has been ploughed under, the conditions become even more unfavourable, and it is therefore advisable that all such growths should be burnt or otherwise destroyed before the ploughing takes place. The danger of allowing these ploughed areas to lie entirely fallow is great, on account of the largely increased loss of nitrogen after the removal of all cover, which it will be difficult and costly to replace. Von Seelhorst made exhaustive experiments in this direction, which proved the eminent importance of keeping such light soils under some cultivation.

In Holland and Westphalia the improvement of Ort heather tracts is practically effected by their intermediate agricultural use. After the soil has once or twice been cultivated with lupins or saradella with the assistance of mineral manures, it is sown with rye or preferably planted with potatoes. In these localities it is generally found that the cost of the preparation and sanitation of the soil is entirely or at least to a great extent recovered, and that in order to effect the subsequent afforestation the cheaper method of sowing may take the place of planting. Where for some reason such intermediate course of agriculture is not feasible, it is nevertheless essential that the ploughed areas should be cultivated with some green manuring plants, in preference lupins and saradella or clover. The cost of such operations should be added to the acquisition of waste land and not to that of cultural operations. W. Borghmann of Tharandt very emphatically expresses the same view. "The cost of such amelioration of the soil should be treated as a capital expenditure, and not in the sense as if the first rotation should be held responsible for its recovery. If it be necessary to regain a lost position, an extraordinary non-recurring but considerable sacrifice may be unavoidable." As regards all normal heather areas—that is, all such in which no hard strata exist—Albert maintains his position in regard to shallow working up of the soil. If, he says, it is considered that in any given locality the subsoil is not sufficiently loose, he recommends a previous cultivation with lupins or saradella, for it is an acknowledged fact that no tool in human hands will effect so thoroughly and cheaply the opening up of the subsoil as the deep roots of such plants.

As regards the choice of species for the afforestation of these heather tracts in North Hanover, the universal opinion is in favour of *Pinus silvestris* as the tree which has the best chance of bringing the soil under cover. Albert recommends, on the strength of Runnebaum's experiments, an admixture of *Alnus incana* on account of its modest soil requirements, its great power of resistance to exposure in open situations (frost and drought), as well as for its favourable influence on the soil. There is nothing in the composition of the brown sand which would prevent a flourishing growth of almost any deciduous tree, but climatic conditions prevent their cultivation in these localities in the open. Having, so far as regards the heather tracts of North-West Germany, solved the question of soils and their treatment, and the choice of species, the selection of the seed is the next question of interest. In the trade in *Pinus silvestris* seed, the source of supply and the percentage of germinations are the only factors by which the price is regulated. No buyer ever thinks of inquiring how many seeds are contained in each Kg., which means that he is indifferent as regards the absolute weight of the individual seed. All the same this is a question of some importance. From a purely physiological point of view no doubt can be felt that the big and heavy seed has, in comparison with the smaller and lighter one, a better developed embryo and a larger supply of reserve nutriment, and that these facts are of great value for the young plant Haak (Germany), A. Buhler (Switzerland), Hoffrath Joseph Frederick and G. Eisenmenger (both of Austria), have made numerous experiments showing that the bigger and heavier seeds give very much better results. The germination of the seeds in sample is, under favourable conditions, maintained in the open, but if these should be less so the advantage of the bigger and heavier seeds becomes evident. Buhler says that the size of the young plant is proportionate to the size and weight of the seed, and that considerably less plants are produced by an equal number of smaller seeds, the difference amounting sometimes to 20 %. Eisenmenger's experiments show that the larger seeds taken from the same supply show a better percentage of germination, and, what is of considerable importance, germinate more readily under trying conditions. He recommends the buying such seeds which, by equal weight, contain the smallest number of individual seeds. He calls it

the "Thousand seed test." Various mechanical appliances have been invented to sort the seeds in accordance with both size and weight. Dr Busse, in experiments with Kayser's centrifugal machine, obtained from an untreated supply containing 216,000 seeds per Kg. two classes, the best containing 140,000 seeds per Kg., the second 172,000 per Kg. This latter is approached and sometimes equalled by the best trade supply.

Haak, though he advises the use of selected seeds for the production of planting material, considers the origin of the seed of such preponderating influence that in open sowings he would consider it waste to exclude the smaller sizes, as in accordance with Engler's experiments the difference observed in the earlier stages of the seedlings disappear in the course of a few years. The hereditary influence of the parent tree, replies Dr Busse, is undisputed and indisputable, but so long as the origin means merely a definition of the locality whence the seed was obtained, no guarantee exists regarding the characteristics of the individual parent trees. Hoffrath Frederick found, in the course of years of experience and experiments, that some of the trees under his observation invariably bear heavier cones than others, and produce heavier and larger seeds, and that the quality of the plants raised from them is decidedly superior to those grown from lighter seeds. That the elimination of the lighter seeds would be an advantage can hardly be questioned, and if the buyers insisted on a weight of 7 grs. or thereabout per 1000 seeds taken at random out of the supply, the trade would unquestionably respond.

The next step in the afforestation of the heather soils is the planting up of the prepared areas with pines and *Alnus incana*, or the sowing where the soil is considered sufficiently ameliorated. Fairly close planting or liberal sowings are advisable, for it is essential to bring the sand soils as soon as possible under cover, in order to prevent the heather from regaining possession and for various other reasons. The excellent results achieved in Holland in similar afforestations are to a great extent due to strict attention to close cultivation.

The forester can now wait till the cover is completed and the plants have thereby outgrown the dangers of infancy, but before the struggle for existence sets in he must interfere and aid. In regard to this a consensus of opinion exists among leading scientists and the most eminent executive foresters. On rich

soils where, *a priori*, the same close cultivation is not essential and not practised, such early interference in the struggle for existence is not called for. Albert maintains that if the forester neglects to reduce on heather sands the number of young trees sufficiently early and periodically and systematically, nature will do so later on in a haphazard and unwelcome manner. He ascribes the numerous disasters in afforestation, which in the first instance led to his visit to the heather tracts, almost solely to negligence in this respect. Dr Schwappach, who has great experience in *Pinus silvestris* cultivation on poor sandy soil, shares Albert's opinion, and ascribes the sickening and frequent breakdowns in the pine cultures solely to a disproportion between the number of trees and the available nutriment and water. This is, in his opinion, the only reason for the dying of whole groups of trees, which he says practically die of hunger and thirst. Root fungi, which were made the scapegoat, appear equally on rich and poor soils with an open and closed formation, and even on single park trees, and though their appearance may be one of the results of such disasters they are not the cause. Dr Schwappach made experiments in a densely-grown area of a 10-year-old pine plantation, isolating the trees in four lines, leaving the next four intact, and so on. Already in the second year the trees in the thinned-out lines show a large increase in growth, as compared with the others, not merely in girth but in height, which latter is quite contrary to the widely spread idea that the consequences of isolation cause a diminution of increase in height. Both Schwappach and Albert recommend an early and repeated cutting-out of the young growth, late in autumn or early in winter, to avoid danger from fire, and covering the ground with the removed plants. Such insects as may breed on the rapidly decomposing woody part are of a harmless nature. The number of stems should be reduced to at least 10,000 per hectare by the time the plantations are ten to fifteen years old.

Oberförster Baumgarten is another strong advocate of an early cutting-out of the dense culture which for light sandy soils is imperative. Light and air, he states, are necessary for the healthy development of the young pine afforestation, and such early removal of the young plants prevents a useless waste of power and strength in the early struggle for existence. He has found out by experience that by such means, and by leaving all

debris on the ground, the rough-shod dying out of trees in the pole stage can be almost entirely prevented.

Erdmann, the past-master of heather land afforestation, has practised on these lines for a good many years with unparalleled success. All such operations mean a certain outlay, as during the earlier periods no income at all is derived, for none of the twigs must be removed for litter, and even at a somewhat more advanced age the sale of the thin poles will not repay the cost of labour. The loss involved, which with careful management need not be excessive per hectare of afforestation, must be regarded in the light of an insurance for the future. It will pay in the end.

The invasion of the thinned-out afforestation by obnoxious weeds is a danger, specially pronounced in the heather climate of North-West Germany, which has next to be combated. Here again Erdmann leads the van amongst practical foresters. His afforestation, in which he underplanted the pine with beech, is a living picture more convincing than any amount of writing and argument. In the Oerrel Lintzel forests, an area of several hundred acres, chiefly composed of grey sand overlying a former Ortstone formation, the ground shines with the vivid green of young beech under a well-grown and healthy pine pole forest of thirty to thirty-five years of age. Erdmann is an almost fanatical supporter of the beech, on which, he maintains, the future of the forest in the north-west heather lands depends. He ascribes the failure in the expected results of underplanting with beech to the fact that the operations were started too late, when the mineral soil was already too deeply covered by moss, weeds, heather or dry peat. In such cases the living surface cover must be removed and the dead mixed with the soil. This may be conveniently effected by a small size of the Geist-Kaehler Wuehl-grubber.

Albert agrees in every respect with Erdmann's opinions, which are based on practical results achieved by himself and his followers, and says that in accordance with his analysis of the soils in these heather tracts there is hardly a place, with the exception of moor soils, where beech could not be successfully cultivated under the protection of pine. Albert thinks that other valuable soil-improving species might with advantage be added to the beech, such as silver fir, larch, Douglas fir and others. In this Erdmann acquiesces, but emphatically protests

against the introduction of red pine into heather land. He has shown the dangers attending this, both to the existing forest and to future generations, owing to a deterioration of the soil, by numerous practical demonstrations, and thereby thoroughly convinced Albert and other admirers of this stately tree.

No doubt need be entertained that, with the treatment described in the foregoing pages, the whole of the still available heather tracts can be transformed into good and valuable forest, and to this end no sacrifice of money and trouble can be considered excessive.

Prof. Dr Schwappach has produced a very interesting treatise regarding the removal of litter from forests of various character, based on investigations extending over a number of years.

The fact that the waste lands in East Prussia owe their origin chiefly to continued and excessive removal of the litter in the forest, which, in olden times, existed on these lands, is not disputed; but it is shown that, except on very inferior soils, periodical collection of litter, by means of light wooden rakes only, does not interfere with the annual increase of wood in forests which have grown into the early pole stage. An advantage is even claimed for the periodical removal of litter as a prevention against the formation of layers of dry peat humus, thereby favouring natural reproduction. Oberforstmeister Guse meets Schwappach's conclusion with the very appropriate rejoinder that a moderate removal of litter may have, and probably has, no disadvantageous effect on the increase of the growing stock on good soils and under favourable conditions, as everywhere in nature a strong organism is able to resist temporary interferences and to outgrow their consequences. He acknowledges that under certain conditions the removal of litter is an unavoidable evil, the worst feature of which, however, is that it is most necessary in localities with poor soil. Whatever applause Schwappach's treatise may find among socialistic agitators, it is condemned by every practical forester. The loss in the increment of the growing forest may be as infinitesimal as was ascertained by Schwappach's investigations, or be entirely absent, but this is really a matter of the least importance. A comparison of the results of re-afforestation in areas never subjected to the removal of litter with those where even a moderate and periodical removal had taken place, is

the best proof of the harm done in this direction. Oberförster Schultz, in whose division forest with litter rights exists side by side with such which are free, reports that the former, though the removal is exercised under the restricting law of 1843, is steadily deteriorating; but what is more interesting, he gives an instructive and convincing example of the harm done by a single removal of the litter. In an old unburned Scots pine forest, the removal of litter was, for pressing reasons, permitted over

Seedlings from an area which has (specimen to right) and has not (specimen to left) had the litter removed.

certain parts thereof in autumn 1905. In spring 1910 this forest was replanted with yearlings of Scots pine, and the living and dead organic matter found on the ground was dug in trenches along the plant lines and lightly covered with sand. The difference between the plants, at the end of 1912, on the areas whence the litter had been removed in 1905 and on those which had remained untouched, is shown in the figure above.

The question of litter rights increases in importance in the same ratio as the poorness of the land and the poverty of the

inhabitants. Owing to cheap forest pasture the head of, mostly underbred and frequently underfed, cattle is, in these localities, almost invariably out of proportion to the holdings; the hay produced is insufficient for the winter feed, and the whole stock of straw is used up as food; the manuring of the fields has to be provided for; and forest litter is the only thing to fall back upon.

Much could doubtlessly be done by raising the price of grazing as well as that of litter, and by providing more labour on forest and other Government work, but such measures are intensely opposed by political parties on the warpath for votes.

15. Supply of Home-grown Telegraph and Telephone Poles.

The following letter was received, early in last July, by the Society from the Postmaster-General:—

"General Post Office, London,
"*8th July* 1914.

"Sir,

"In connection with the Telephone Development Scheme which is being actively carried out by the Post Office, the Postmaster-General has recently had to place contracts for the supply of upwards of 100,000 wooden poles in addition to those deliverable (some 65,000) under the annual contracts placed last autumn for the normal needs of the service.

"Mr Hobhouse has felt the greatest regret that British forestry has had no share in contributing to this supply; and, in his desire to bring the subject once again to the notice of owners of woodlands and forests in the United Kingdom, and of merchants concerned in finding markets for native timber, he seeks the good offices of the press, in the hope that it will co-operate with him to encourage interest in British forestry.

"Mr Hobhouse is acquainted with the repeated efforts which the Post Office has made in the past to encourage British supplies, and with the very small amount of timber which has been obtained as the result of those endeavours. In particular, attempts were made in 1909 to attract supplies of home-grown timber, but with results deeply disappointing to the then Postmaster-General. The annual requirements of the Post Office in

the matter of wooden poles amount to many thousands; but the yield from British sources has been a few hundreds only. So meagre a response to a constant and increasing demand can only be regarded with the keenest disapppointment and regret, and to secure a larger measure of success for and from British growers, no effort will be spared by the Post Office.

"The principal places where delivery is required are London, Hull, the Tyne District, Methil (Fife), Ardrossan, Ellesmere Port, Newport (Mon.), Southampton and Belfast.

"In the opinion of the Department's expert officers two descriptions of timber stand out before all others as most suitable for the purpose in question, in respect both of weather-resisting properties and general shapeliness, viz., *Pinus silvestris*, commonly known as red fir or Scots pine, and *Larix europæa* or larch.

"Both of these species are easily and commonly grown in the United Kingdom, but failure to meet the requirement of length and thickness combined have led to the rejection of much of the British timber offered to the Post Office by growers, whose supplies the Postmaster-General would otherwise have been only too glad to accept at fair prices.

"The specification includes 21 lengths ranging from 16 to 85 feet, and provides for a minimum diameter at the top of the pole ranging from 5 inches in the case of the lightest to 8 inches in the case of the heaviest.

"In view of the Department's very large needs for wooden poles, it is to be hoped that home growers and merchants may yet make fresh or renewed efforts to compete for a share of the business; and to this end Mr Hobhouse suggests that anyone desirous of further information on the subject should address an inquiry to the Controller, Post Office Stores Department, 17-19 Bedford Street, Strand, London, who will gladly afford all information in his power.

"I am, Sir,

"Your obedient Servant,

"H. C. Guest.'

The above letter was submitted to the Council of the Society, and the Secretary was instructed to write to the Controller pointing out that the conditions of contract, as set forth in the tender form (No. 264), for the supply of telegraph poles (home-grown) was such that most proprietors of suitable timber

were unwilling to take the risk of having their consignments rejected, after incurring considerable outlay in its transport to a distant depot, where, according to the then existing conditions of contract, inspection was first made.

In reply a letter was received inclosing the following memorandum giving information regarding the Department's requirements, and setting forth certain modifications which, in the interests of home growers and timber merchants, the Postmaster-General was prepared to make in the usual conditions of purchase.

TELEGRAPH POLES FOR THE POST OFFICE.

Memorandum to accompany Tender Form No. 264, for home-grown Poles—Scots pine or larch.

The full range of sizes included in the specification is—

Light poles—18 to 60 feet
Medium poles—18 to 60 feet
Stout poles—26 to 85 feet

} For details, see page 6 of tender form.

The sizes of telegraph poles most commonly used in this country are:—

Light.—22 to 30 feet in length, not less than 5 inches in diameter at the top, and of a minimum diameter 5 feet from the butt end of $6\frac{1}{4}$ inches for 22 feet, rising to $7\frac{1}{4}$ inches for 30 feet.

Medium.—24 to 34 feet in length, $5\frac{1}{2}$ to 6 inches minimum at top, 8 to $9\frac{1}{4}$ inches 5 feet from butt. Also 36 and 40 feet in length, 6 inches minimum at top, $9\frac{1}{2}$ and $9\frac{3}{4}$ inches minimum 5 feet from butt.

Stout.—32 to 50 feet in length, $7\frac{1}{2}$ to $7\frac{3}{4}$ inches minimum at top, 11 to $13\frac{3}{4}$ inches minimum 5 feet from butt.

(All measurements are under bark.)

In the case of larch the specification requirements will be modified as follows:—

Light poles.—18, 20, 22, 24 feet, minimum diameter at top may be $4\frac{1}{2}$ inches; 26, 28, 30, 32 feet, minimum diameter at top may be $4\frac{3}{4}$ inches.

Medium poles.—All sizes minimum diameter at top may be $\frac{1}{4}$ inch less than specified.

Delivery.—Delivery is taken at the creosoting yards of which there are fifteen, situated at various points on the coast. A list will be found in para. 4 of the Notice to Persons Tendering.

Inspection of Felled Timber.—The tender form provides for inspection after delivery at the creosoting yard, but the Postmaster-General is prepared to arrange for inspection before despatch, provided that a sufficient number of poles are collected in a suitable place, and that the seller provides the necessary labour for turning over and handling.

It is preferred that the examination be made after the outer and inner bark has been removed as specified, but if the seller specially desires it, the Post Office Inspector will examine before the bark is removed, throwing out all unsuitable timber, and stamping all accepted poles at the butt end. Such poles must be "barked" immediately after acceptance.

The inspection on the spot, whether of barked or unbarked timber, will be final. Payment will be made on due receipt of the poles at the creosoting depot.

Inspection of Standing Timber.—In certain cases the Department will arrange for an inspector to view standing timber, ascertain the probable suitability of the trees for telegraph poles, and say how they should be dealt with in order to yield poles of the sizes given in the specification. The preliminary conditions will usually be, (*a*) that the grower or merchant has had no previous experience, (*b*) that a rough estimate of the number of poles that could be supplied and an idea of the price be furnished. A firm offer can be made after the inspector's visit.

Any standing timber respecting which advice has been given would be subject to inspection after felling, etc.; the conditions of final acceptance being, that the timber is sound, and that the poles are of the sizes required.[1]

Carriage, etc.—The contractor should provide for (and pay all charges for) haulage to the railway station, loading up of trucks, and delivery to the nearest Post Office creosoting depot.

Quotations.—Prices should be *per pole* for each of the lengths and dimensions tendered for, delivered to a creosoting depot to be named by the person tendering, and the approximate quantities it is proposed to supply should be stated. If for any reason the full numbers cannot be supplied, the Postmaster-General will regard the order as completed; on the other hand, he will accept excess poles at contract prices within reasonable limits.

[1] Schedule on page 7, and specification on page 6, tender form No. 264.

Separate prices should be quoted for larch and for Scots pine. (See accompanying table showing the average cubic contents for the various sizes of poles.)

Short lengths.—If it will assist the contractor—the Postmaster-General will take twenty short lengths (round pieces, 8 feet long 5 to 6 inches in diameter) for every hundred poles supplied.

A price (delivered at depot) should be quoted for these.

POST OFFICE STORES DEPARTMENT,
17-19 BEDFORD STREET, LONDON, W.C.
November 1914.

TABLE OF AVERAGE CUBICAL CONTENTS (STRING MEASURE [1]) OF RED FIR TELEGRAPH POLES, BASED ON MEASUREMENT OF POLES IMPORTED FROM SCANDINAVIA.

Length	Light	Medium	Stout
Feet	Cubic Feet	Cubic Feet	Cubic Feet
16	2·2 (app.)	...	...
18	2·7	...	...
20	3·04	4·02	...
22	3·61	4·71	...
24	4·15	5·65	...
26	4·77	6·39	9·46
28	5·39	7·75	11·20
30	6·09	8·40	12·20
32	6·83	9·65	14·46
34	7·59	10·73	16·24
36	8·55	12·13	18·11
40	10·77	15·34	21·69
45	13·61	18·58	26·50
50	16·39	22·56	31·20
55	20·21	29·85	40·76
60	25·31	33·45	47·20
65	30·51	42·20	53·40
70	35·85	51·50	63·73
75	37·30	54·70	81·30
80	...	...	...
85	...	...	108·00

[1] String measurement is tape under bark, quarter-girth measurements, at middle of pole, 144 divisor; *e.g.*, a 30-foot pole with 5 inches quarter-girth would be $\frac{5 \times 5 \times 30}{144} = 5{\cdot}21$ cubic feet.

16. Methods of Nursery Work.

(With Plate.)

By Alex. Murray, Murthly.

The following notes have been contributed in consequence of numerous inquiries, and the general interest taken by all who have seen the results of the methods practised here.

The methods adopted are not new, and merely consist of an artificial method of producing as near as possible a natural formation of roots. If we examine carefully the root of a naturally grown young tree, we find that the main root is vertically placed under the stem and often penetrates to a great depth into the soil. If we now examine, in the same way, a young plant from a nursery line, we do not find the same formation of roots. The stem is generally twisted and bent, while the roots are also doubled and so mutilated that they can ill perform their functions. The plants are less healthy, and more often fall a prey to insect attacks and fungoid diseases.

The method of natural regeneration of forests is certainly superior in every way to any artificial method, but as our existing conditions do not often lend themselves to natural regeneration, the next best thing we can do is to study nature and follow her example as closely as possible.

Line v. *Broadcast Sowing.*—There are many advantages to be derived from the rearing of seedlings in lines or rows compared with the broadcast system. Two general objections to the method are (1) the supposed extra time taken to perform the work, and (2) the extra ground that is taken up with the plants. But the work can be properly carried out with the aid of a few necessary but simple and inexpensive tools. The time spent is not greater than in the broadcast method, while the plants produced are superior in every way. Also, when one takes into consideration that all the plants are of an even size, the number of good plants produced in the same space may be greater than in the case of broadcast sowing.

One other advantage of line sowing is the saving of the labour necessary for hand-weeding. The spaces between the rows are cleaned with a narrow hoe, and the soil may, in the same way, be stirred to a considerable depth, thus allowing a

free circulation of air, which is a matter of the greatest importance to plant growth. To this alone is probably due the increased vigour of growth. In broadcast sowing it is not possible to keep the soil in such good condition, and it is quite common on many soils to find the surface coated with a form of moss or liverwort which renders the soil impervious to air. On soils given to frost lifting, a layer of leaf-mould or of prepared cinders placed between the rows will act as a preventive. Finally, in lifting the plants there is considerably less mutilation of the roots.

The illustration (Plate IX. Fig. 1) will of itself explain the method of sowing, but the following remarks may be useful :—The ground on which the seeds are to be sown is prepared in the usual way, and the beds formed at a width of 4 feet with an alley between. The roller shown in Fig. 1 is then drawn over the beds, and so forms the grooves in which the seeds are sown. These grooves are formed by laths, $1\frac{1}{2}$ inches broad by $\frac{3}{8}$ inch deep, fixed on the roller at intervals of $4\frac{1}{2}$ inches. In these grooves the necessary amount of seed is sown by means of a sowing-lath.

The seed-box is 4 feet long, quite narrow, and has a round bottom. The sowing-lath has a groove in it which is regulated to lift the necessary amount of seed and is worked by two men, one at each end.

The depth at which the seeds are sown is a most important matter. We have noticed that the laths fixed on the roller are $\frac{3}{8}$ of an inch thick, so that the covering on the seed is regulated to this depth. If greater depth or wider space be required the laths can be altered to suit circumstances.

The covering consists of soil prepared by being passed through a $\frac{1}{2}$-inch riddle, and is put on in the same way as the seeds are sown, the lath used being of a size to lift the proper amount of soil covering.

To complete the operation the plain roller shown in the background of Fig. 1 is drawn over the beds.

By this method the seeds are sown at an even depth, which insures an even germination and consequently an even size of plants.

When the plants have reached their second year's growth they are transplanted in nursery lines. Several species, however, are transplanted as 1-year seedlings. The object in transplanting is to encourage the formation of fibrous rootlets. The welfare of the plants depends on the state of the roots, it is therefore obvious

that the utmost care should be taken when lifting them from the seed-beds. When plants are reared in lines the minimum of damage will be done in this way.

The distance between the lines and the space between the plants in the lines depend on their size and species. For 1- and 2-year-seedling conifers the lines should be 9 to 10 inches apart, with about eighteen plants to the lineal yard in the line. If the plants are grown more crowded, they have neither room for the proper development of their roots nor their branches.

Since the production of successive crops of tree-plants causes a heavy drain on the mineral constituents in the soil, these last elements must be restored. This may be done by means of a dressing of thoroughly well decayed farm-yard manure mixed with well decomposed compost formed from decayed leaves, scourings of ditches and road-side material. A little lime or basic slag may with advantage be added.

A coating of this composition should be spread over the ground on which the plants are to be lined, and previous to the lining operations the ground should be carefully dug over, thus thoroughly mixing the top dressing with the soil.

A spit of soil is first removed all along the line when the work of lining is to begin. Digging is done to a width of 6 inches past the point where the first row of plants is to be placed. A garden line should then be stretched along the surface and a trench prepared for the reception of the plants.

It is always necessary to observe that the trench is of sufficient depth to allow the roots to hang vertically under the plants.

It is important that no bending of the roots should take place, and that the plants should be inserted at the correct depth in the soil. Both of these objects can be attained, with mechanical precision, by the use of a simple piece of apparatus known as the planting lath.

These laths may be of any length, but a length of from 10 to 12 feet is found to be most generally convenient. The length of lathing available should be equal to double the length of the lines which are to be planted, so that when one set is in use at the planting line, the other set is being filled (see Plate IX. Fig. 2).

It will be seen that the plants are inserted into small notches or slits which are cut in the laths, at 2 to $2\frac{1}{2}$ inches apart. The laths for convenience of filling are inserted on edge in two

FIG 1. THE SOWING OF THE SEED.

FIG. 2. TRANSPLANTING THE SEEDLINGS WITH THE PLANTING LATH.

base blocks, and when filled they are laid flat on the top of the open track, allowing the roots of the plants to hang freely and with sufficient space between them for the development of fibrous roots, while there is no doubling and twisting as in the case of hand-laying.

The soil removed in opening the trench for the plants is then turned back with the spade and lightly trodden with the foot. The laths are then withdrawn in a lateral direction, and part quite easily from the plants. The expense of hand-laying and laying with the lath works out exactly the same, but the plants produced by the lath system are much superior to those produced by hand-laying.

It will be seen that with the aid of the lath the roots are allowed to retain their natural position, consequently they develop evenly on all sides and form a close, compact, fibrous root-system. When plants thus raised are planted out in the open by means of the semi-circular planting spade the same natural position is retained.

It is principally owing to the destruction of roots that we get so many crooked and short-stemmed trees with branchy crowns, which are so similar to those which have been dwarfed and deformed through injury to their roots caused by the action of a pan.

17. Nursery and Plantation Competition.

The Nursery and Plantation Competition of 1914 was held in the Border district, at the Highland and Agricultural Society's Hawick Show, and embraced the counties of Berwick, Peebles, Roxburgh and Selkirk. This was the third Competition of the kind held under the auspices of the Society. The first Competition, in 1912, covered a representative portion of the Midlands of Scotland, while the second Competition, in 1913, included a representative area in the West, and the 1914 Competition covered an area representative of the Border district of Scotland.

In order to classify the subjects entered in these Competitions, it is necessary that the Judges should be supplied with statistics concerning the history and management of the competing subjects, especially in the case of plantations. The result of this is that much information of great value is collected in the various districts, and by the time a complete round of the

Highland and Agricultural Society's Annual Show districts has been made, the sum of the statistics thus collected will be of the highest interest and importance to silviculture. These statistics will not only yield immediate results, by showing how the silvicultural conditions vary in different parts of Scotland, but they will form a very valuable basis for future study and research concerning each individual plantation which has been entered in the Competition. As was pointed out[1] in the report of the 1912 Competition, some of these plantations may improve while others may deteriorate as time goes on, hence the recorded classification of these plantations, together with the recorded information concerning them, will afford a valuable and reliable basis for the future investigator; and if such investigations are systematically made and recorded, the final result will indicate the best system of management and kind of crop for each locality. With this end in view, it has been decided by the Council of the Society that in future the full details supplied concerning the various competing plantations shall be published.

In the 1914 Competition five nurseries were entered, two in Class I. and three in Class II., while the plantations numbered eight, seven in Class IV. and one in Class V. It is rather significant to note that, as in 1913, there were no entries in Class VII., which is for hardwoods.

The nurseries and plantations are given below in order of merit.

NURSERIES.—*Class I.*

Estate	Proprietor	Forester
Dawyck	F. R. S. Balfour	R. Tindal.
Riddell	Captain Sprot	A. T. Kinnear.

Class II.

Minto	Earl of Minto	Francis Berry.
Bowmont Forest	Duke of Roxburghe	George Leven.
Mellerstain	Lord Binning	...

PLANTATIONS.—*Class IV.*

Estate	Species	Age
Bowmont Forest	Japanese larch (pure)	9 years.
Dawyck	*Picea sitchensis* ,,	5 ,,
Riddell	Conifers	4–5 ,,
Bowmont Forest	Conifers	7 ,,
Dawyck	Japanese larch	6 ,,
Cavers	Conifers	7–8 ,,
Riddell	Conifers	6–7 ,,

[1] Vol. xxvii. part 1, p. 88, *Trans.*

Class V.

Estate	Species	Age
Cavers	Conifers	15 years.

The general standard of the thirteen subjects selected and entered in the Competition was of a high order, and they presented many features of interest which would well repay further investigation, and it is to be hoped that continued records of all the plantations will be kept.

The nurseries were all abundantly stocked with healthy young orest trees of different kinds, in various stages of preparation for planting out in the forests. Where all attained a high standard of merit it may seem invidious to single out one for special mention, but the nursery at Dawyck stands alone as regards the quality and variety of its stock. This nursery is unique in the variety of its collections in coniferous and deciduous species. Nowhere in Scotland can a greater variety of conifers, even to the most recently discovered and introduced species, be seen.

The preponderance of plantations in Class IV.—*i.e.*, under ten years old—is rather striking, and this might lead to the deduction that conifers grow best during their first ten years in the South of Scotland, as one might naturally suppose that only the best on each estate is entered in the Competition. Such a deduction, however, would be entirely wrong. Conifers grow well at all ages in this as in other parts of Scotland. The preponderance in Class IV. is, we hope, due to improved methods and increased activity in planting. It was not within the scope of the Judges' duties to investigate this subject further, but in the event of the Society adding to these Competitions one which would include the whole forestry management of each estate, the additional information which would be thus obtained would increase enormously the usefulness of these investigations.

The Judges beg to tender their heartiest thanks to the proprietors of the estates visited, and to their representatives, also to the Secretary, Mr R. Galloway, for much valuable assistance in the work of arranging and carrying out their inspection of the competing nurseries and plantations.

The accompanying tables give the particulars of the plantations entered in 1913 and 1914 respectively.[1]

[1] For particulars of the 1912 plantation competition, see vol. xxvii. part 1, p. 94, *Trans.*

PARTICULARS OF PLANTATIONS, 1913.

NAME OF ESTATE .	**Montgreenan.**	**Glenstriven.**	**Glenstriven.**
Description . .	SCOTS PINE and NORWAY SPRUCE.	CONIFERS.	CONIFERS.
Area	140 acres.	5 acres.	6 acres.
Class . . .	I.	II.	III.
Soil	Peat bog, covered with heather.	...	...
Elevation . . .	240 feet (about).	350 to 450 feet.	250 to 350 feet.
Rainfall . . .	About 70 inches.	About 75 inches per annum.	About 75 inches per annum.
Aspect . . .	About level.	Facing west.	Facing west.
Shelter . . .	None.	From north winds.	From north winds.
Previous occupation of land	Uncultivated boggy peat.	Hillside (sheep).	Hillside (sheep).
Rent of land adjoining the Plantation	Cultivated land about 30s. per acre.	6d. to 1s. per acre.	6d. to 1s. per acre.
Date of planting .	April 1910.	1900.	1877-78.
Cost per acre . .	Not known.	About £50.	About £50.
(*a*) Fencing . .	Iron standards with 7 wires (strand) with wire-netting.	...	Only from sheep.
(*b*) Draining . .	Open drains 2 to 3 feet deep, 15 to 18 feet apart.	...	Practically none.
(*c*) Planting, including beating up	No beating up.	...	...
(*d*) Cleaning . .	None.	...	Very little attention.
(*e*) Soil cultivation or other outlay, if any	In planting ground, limestone rock on part and basic slag on part.	...	None.
Species planted and, if more than one, relative proportions of each	Scots pine and Norway spruce in about equal proportions. 4000 per acre.	Larch.	Larch.
Age of plants . .	3 years.	2-year 2-year plants.	2-year 2-year plants.
Method of planting and number of plants used per acre	German, with German spade of this shape **S**. About 4000 per acre.	Notching; 3300 per acre.	Notching; 3000 per acre.
Date of thinning, if any	None.	1911-12.	Unknown, but more than once.
Damage by fungi, insects, birds, rabbits, hares, squirrels, or other creatures	None; the wire-netting protects from hares and rabbits.	...	...
Damage from other causes	None yet noticeable.	...	...

PARTICULARS OF PLANTATIONS, 1913—*Continued.*

Glenshant.	**Knocken Wood.**	**Mount Stuart.**	**Mount Stuart.**
Larch and Scots Pine.	Conifers.	Japanese Larch.	Japanese and European Larch.
70 acres.	41 acres.	20 acres.	7 acres.
IV.	IV.	IV.	IV.
Light gravelly.	Partly light gravelly, and partly peat.	Free sandy loam on top of rock.	Sandy loam and clay.
100 to 500 feet.	From 250 to 550 feet.	200 feet.	200 feet.
70 to 80 inches.	70 to 80 inches.	50 inches.	50 inches.
Southerly.	Southerly.	Easterly.	Westerly by south.
...	..	North and south-west.	East and south.
Wood.	Wood and deer forest.	Old beech and oak.	Small oak.
Deer forest.	Deer forest.	18s. to 25s. per acre.	15s. per acre.
1904 to 1907.	1912.	Feb. and March 1908.	Commenced 20th Feb. 1905.
...	...	Doubtful.	Doubtful.
Total £250. Deer fence.	£280. Fence 6 feet high.	,,	,,
£10.	£12.	,,	,,
..	5000 plants 10s., labour £2.	,,	,,
...	Cutting brackens, season 1912, £7, 10s.	,,	,,
...	...	,,	,,
...	97,000 larch; 45,000 Scots; 18,000 spruce; 1000 sitka; 1500 silver; 350 plane; 750 beech; 50 *Douglasi*; 350 ash. Mostly 2-year 2-year.	Japanese larch and *Picea nobilis*, with Scots and Austrian pine for shelter at top.	4 acres Japanese larch; 3 acres European larch.
..	...	Larch 2-year 2-year; *nobilis* 6-year.	2-year 2-year.
..	Notch for conifers; hardwoods pitted; 4000.	Japanese larch notch planted, 4 ft. apart. *Picea nobilis* pit planted, 24 feet apart.	Notch planting, 2722 per acre.
...	...	None.	No thinning.
...	...	Practically none.	No damage.
...	...	None.	None.

PARTICULARS OF PLANTATIONS, 1914.

Name of Estate	**Bowmont Forest.**	**Dawyck.**	**Calla.**
Description	Conifers.	Sitka Spruce.	Conifers.
Area	5·6 acres.	10 acres.	15 acres.
Class	IV.	IV.	IV.
Soil	Shallow sandy loam over pan.	Whinstone, with some clay.	Till to loam.
Elevation	540 to 590 feet.	800–900 feet.	600 feet.
Rainfall	27 inches.	35–43 inches.	Average for Roxburghshire.
Aspect	Northerly.	North.	In and on margins of a small ravine.
Shelter	Exposed to west winds.	From east and west.	North side of high ground.
Previous occupation of land	Crop of Scots pine.	Mixed wood felled immediately before planting.	Woodland growing fine larch, ash, and Scots pine.
Rent of land adjoining the Plantation	12s. 6d. per acre.	Grazing parks on better land, 7s. per acre.	Grass parks at about 10s. per acre.
Date of planting	1905.	1909.	Season 1909-1910.
Cost per acre:			
(*a*) Fencing	£4.	£1 per acre (approximate).	Original fencing, mostly.
(*b*) Draining	4s.	None.	About £5.
(*c*) Planting, including beating up	£5, 4s.	£3, 15s. (approximate); no beating up.	...
(*d*) Cleaning	None.	None.	About £8.
(*e*) Soil cultivation or other outlay, if any	Strip trenching "frost hole," £1, 5s.	None, except removal of second leaders.	...
Species planted and, if more than one, relative proportions of each	Jap. larch (pure); beating up of "frost hole" was done with Banks' pine.	All *Picea sitchensis*, with a few "bat" willows at edge of the burn.	Larch, pine, and spruce in about equal quantities, with some Douglas fir in hollows.
Age of plants	2-year 2-year.	2-year 2-year.	2-year 2-year.
Method of planting and number of plants used per acre	All notched; 4840 per acre.	Notching; about 3000.	Notching: 5000 per acre.
Date of thinning, if any	...	None.	...
Damage by fungi, insects, birds, rabbits, hares, squirrels, or other creatures	Very slight damage done by pine weevil.	A few trees by fungus *Armillaria mellea*, Vahl.	Certain amount by hares, rabbits, cattle, and sheep.
Damage from other causes	"Frost hole" plants damaged until strip trenching resorted to.	None.	By frost to Douglas and larch (replaced since by Norway spruce).

PARTICULARS OF PLANTATIONS, 1914—*Continued.*

Bowmont Forest CONIFERS. 10·6 acres. IV.	**Dawyck.** JAPANESE LARCH. 23 acres. IV.	**Cavers.** CONIFERS. 8 acres. IV.	**Riddell Bank.** CONIFERS. 12 acres. IV.	**Cavers.** CONIFERS. 10 acres. V.
Sandy loam.	Light, stony formation.	Strong retentive clay.	Loam to till.	Very poor, often only 3 ins. deep.
550 feet.	850 to 950 feet	700 feet.	700 feet.	718 ft.
27 inches.	35 to 43 inches.	...	Average for Roxburghshire.	...
Westerly.	North.	North-west.	S.E.	West.
Exposed to W. and S.W. winds.	None.	None.	Partly by wood on S. and S.W.	None.
Crop of Scots pine.	Scanty larch wood felled 30 years ago.	Arable.	Wood. Spruce in one part and good hardwoods.	Grazing.
12s. 6d. per acre.	Grazing parks on better land, 7s. per acre.	15s. 6d. per acre.	Grass parks at 15s. to £1 per acre.	10s. per acre.
1907–08.	1908 (spring).	1906 and 1907.	Seasons 1907–8 and 1908–9.	1898-99.
£4, 4s.	£1 per acre (approximate).	132 roods, 6 lines wire fencing, with larch stakes, at 3s. 3d. = £21, 9s.	Original fences.	82 roods, 6 lines galv. wire, with larch stakes, at 3s. 3d. = £13, 6s. 6d.
None.	None.	120 roods at 4d. = £2.	About £8.	None.
£4.	£4, 18s. (approximate).	About £42.	About £2.	£50.
3s.	10s. (approximate)	£2.	...	None.
None.	None.	Wire-netting, £7, 10s.	...	Wire-netting, £4.
Scots pine (pure) 9·464 acres; Japanese larch (pure) 1·178 acres, with a few spruce, Menzies and white American spruce, Austrian and Banks' pine.	All *Larix leptolepis*.	Scots fir and spruce about half and half, with a few *Douglasi* and hardwoods about 10 feet apart.	Japanese and European larch, Scots pine and Norway spruce, in about equal numbers, with a few Douglas and ash.	One half Scots fir and one quarter spruce, remaining one quarter hardwoods and Japanese larch. One acre of Japanese larch.
2-year 2-year.	2-year 1-year.	Hardwoods 2 to 3 feet, others 2-year 2-year.	2-year 2-year.	Firs 1-year 1-year, spruce 3-year, larch 2-year 2-year.
All pitted; 2722 per acre.	Notching; 3550 per acre.	Notch for conifers, and pits for hardwoods and *Douglasi*; 4000 per ac.	Notching; about 5000 per acre.	Notch planting; pits for hardwoods; 4000 per acre.
...	None.	Very slight clearing of blown plants, 1913.	...	Slight clearing 1907, and slight thinning 1912.
Slight damage by pine weevil and pine root fungus.	Pine weevil or black game.	Scots pine damaged by black game.	*Chermes* on larch; Rabbits and hares.	...
None.	Damage from wind.	...	Tops of many Japanese larch lost.	Very badly blown to one side.

18. Forestry Exhibition at the Highland and Agricultural Society's Show at Hawick, 14th to 17th July 1914.

The Border counties included in the Hawick Show district provide wide contrasts in forest growth. In the haughs and sheltered valleys of the Tweed and its tributaries at the lower altitudes, excellent growth of many of the broad-leaf timber trees is to be found; the timber of such species as ash, sycamore and beech often indeed rivalling in size and quality that to be found in the recognised hardwood districts farther south. The oak, especially the Sessile variety, also gives a fair account of itself in timber production. No better quality of Scots pine timber can be found anywhere in the country than that grown on the deep sands and gravelly loams on the banks of the Tweed. Higher up on the sheltered slopes of the hills of the southern uplands of Scotland larch and spruce are equally at home.

A reflection of this pleasing variety of suitable conditions for forest growth in the district was to be found in the exhibition of timbers and other woodland produce at the Hawick Show. In the competitive classes, although the display was not so large in the aggregate as at some former Exhibitions, the standard of quality was very high both for broad-leaf and coniferous timbers.

In the competition for larch timber in plank-form there were eight entries. The first prize was awarded to the Earl of Minto for very fine well-hearted samples of larch. The planks sent by Sir John A. Dewar of Dupplin, and awarded second prize, came little short of the first in the total quality points, and a very good lot also were those sent from the Duke of Roxburghe, to whom the third prize was awarded. The Highly Commended ticket was given to the Duke of Buccleuch for a very nice lot sent by Mr D. Crabbe.

The competition in Scots pine timber was also a good one, eight exceedingly interesting lots being staged. The first prize was awarded to Sir John Dewar, the second prize to the Earl of Minto, and the third to the Duke of Buccleuch.

The competition for spruce timber was less satisfactory. There were only four entries in this case, and the quality of the spruce boards was not up to the same high standard as that of the larch and the pine. The outstanding feature was size rather than high quality. Although the pieces of timber shown had been very carefully prepared and seasoned so as to show to the

best advantage, yet the conspicuous high quality of the pine and larch was clearly lacking in this case. The planks had been sawn from trees of very rapid growth—trees grown probably in open order—with the result that the timber was soft and carried an undue proportion of springwood. The best sample, to which first prize was awarded, was that sent by Sir John Dewar. Second and third prizes, respectively, were awarded to the Duke of Buccleuch and the Earl of Minto.

There was an excellent display in the competition for ash timber, there being eight entries in this class, from different woodland owners. The first prize was given to the Earl of Minto for well-prepared planks of tough, nicely-coloured timber. The second prize went to the Duke of Buccleuch, also for good-sized planks. The samples sent by Captain Stirling, to which third place was given, had also much to recommend them.

The display of oak planks in Competition No. V. was extremely interesting, and the Judges had considerable difficulty in making their awards. This difficulty was to some extent enhanced by the state of preparation in which the timber was put forward by the various competitors. Oak timber, in order to retain its high quality, must, if possible, be slowly seasoned—the first stages in the log, the later stages in thick plank form. In some cases the samples shown had been taken from recently felled sappy logs, and thus did not show to advantage. The first prize was awarded to the Earl of Minto, for large, sound, nicely-coloured, well-matured planks. The second prize went to the Duke of Buccleuch, also for sound material of great merit, and the third prize was awarded to Captain Stirling of Keir, for a lot very nearly equal to the second. Highly Commended tickets were also attached to the samples sent by the Duke of Roxburghe and Captain Palmer Douglas of Cavers.

For specimens of elm timber the first prize was awarded to the Duke of Roxburghe, for well-hearted planks of decidedly outstanding merit. The second prize went to Captain Stirling of Keir, and the third to the Earl of Minto.

In the competition for timber of broad-leaf trees other than ash, elm and oak, there were two divisions, viz., an Open Section and a Local Section. In this competition a good collection of such useful timbers as sycamore, beech, hornbeam, sweet chestnut and poplar were put forward. The first prize in the Open Section was awarded to Sir John Dewar, the second prize to the Duke of Roxburghe, and the third to the Duke of

Buccleuch. In the Local Section, the first prize went to the Duke of Roxburghe.

There was also a competition divided into two sections for coniferous timbers other than larch, pine and spruce. The entries included such timbers as Douglas fir, Lawson's cypress, giant *Thuya*, silver fir and Corsican pine. In this competition, first prizes went to the Duke of Roxburghe both in the Open and Local Sections. The second prize in the Open Section was awarded to Captain Stirling, and the third prize to Sir John Dewar.

A useful competition, and one which usually attracts much attention, is that of the construction from home-grown timber of various designs of gates. For a gate constructed by exhibitor, Silver Medals were awarded to Mr James A. Donald, forester, Dupplin, Mr Lewis Rae, assistant forester, Dupplin, and to Mr D. MacMillan, forester, Keir.

For gates designed by exhibitor but made by an estate tradesman a No. 1 Silver Medal was awarded to Mr J. A. Donald, Dupplin; No. 2 Silver Medals to Mr W. M. Price, factor, Minto, and Mr Francis Berry, forester, Minto; and a No. 3 Silver Medal to Captain Sprot of Riddell. For a self-closing wicket-gate a No. 1 Silver Medal was awarded to Mr David Crabbe, forester to the Duke of Buccleuch. The whole of the gates were shown in working condition. They were all of excellent design and workmanship, and reflected great credit on the exhibitors.

For full-sized sections of fencing constructed from thinnings, a Silver Medal was awarded to Captain Sprot of Riddell.

For specimens showing the effect on the quality of timber of the dense and open methods of cultivation, Captain Sprot was awarded a No. 3 Silver Medal for stems of spruce shown at forty years of age. The Duke of Roxburghe (*per* Mr Geo. Leven) was awarded a No. 1 Medal for stems of spruce and Corsican pine.

In Competition No. XXI., for any useful invention or improved implement used in forestry, Mr David Crabbe was awarded a No. 2 Silver Medal for a very substantially constructed portable tramway and timber bogie for use in situations where roads are expensive of construction. Mr R. G. Grant, The Manse, Aberdalgie, Perth, gained a Silver Medal in the same section for a very serviceable implement for extracting tree stumps, and also a Bronze Medal for an ingenious pit-trap for rabbits, which could be used on either side of a wire-net fence. This pit-trap

method of catching these vermin is much more humane than by the ordinary spring-trap, and Mr Grant's invention may prove a most useful one.

For collections of fungi injurious to forest trees, Silver Medals were awarded to Mr H. R. Munro, Great Witley, Worcester, Mr S. Fraser, Hopetoun, and Mr A. Fish, Kinneil Estate, Bo'ness.

In the non-competitive classes there were many very useful exhibits.

A No. 1 Silver Medal was awarded to the Duke of Buccleuch for a large exhibit including specimens of stems and samples of soil and surface layers, and diagrams illustrating the growth of a pure crop of spruce; specimens of stems and diagrams illustrating the growth of young crops of Japanese larch; maps showing methods of distinguishing age-classes in woods, records of timber production, etc.

Silver Medals were also gained by the Duke of Roxburghe and Sir Duncan Hay of Haystoun, Peebles, for specimens of young trees and stems illustrating the growth of European and Japanese larch, Douglas fir and spruce, etc. The advisability of planting Japanese larch in preference to the European species has been much discussed in recent years. It may be too soon to form a definite opinion of the value of Japanese larch for general planting, but it has already proved itself wonderfully adapted to the deep dry pine soils of Bowmont forest and to the light soils on the lower Silurian formation on the Peebles and Selkirk hills.

Captain Sprot of Riddell had a very instructive exhibit for which a Silver Medal was awarded. It included examples of trees and stems showing the effects of full exposure and partial shelter on the rate of growth of various plantation trees; also stems with examples of larch disease (canker), and spruce showing the effect of *Chermes laricis*.

Silver Medals were awarded for collections of home-grown timbers to Captain Douglas of Cavers and to Lochiel, and to the Earl of Mansfield, *per* Mr F. Scott, for a transplanting frame with specimens of pine transplants of three and four years' growth, contrasting results with the frame and the ordinary transplanting method by hand. The straightness of roots and rootlets resulting from the frame transplanted trees would appear to justify the use of the transplanting frame.

An exhibit of very great importance, and of special interest at the present time in view of the scarcity of pitwood, was the

collection of home-grown railway and pit timber sent from Dupplin by Sir John Dewar. It included—

1 railway sleeper, 10 inches by 5 inches.

Pitwood crowns—

1 pine, 9 feet by 9 inches by $4\frac{1}{2}$ inches.
1 ,, 9 ,, 8 ,, 4 ,,
1 ,, 8 ,, 8 ,, 4 ,,
1 ,, 7 ,, 8 ,, 4 ,,
1 ,, 6 ,, 8 ,, 4 ,,
1 ,, 7 ,, 5 ,, $2\frac{1}{2}$,,
1 ,, 6 ,, 6 ,, 3 ,,

Pit tramway sleepers—

1 pine, 3 feet 9 inches by 6 inches by 2 inches.
1 ,, 3 ,, 9 ,, 5 ,, 2 ,,
1 ,, 3 feet by 6 inches by 2 inches.
1 ,, 3 ,, 5 ,, 2 ,,

Round pit sleepers—

10 pairs, ranging in length from 3 feet to 12 feet long, diameter from 3 inches to 7 inches at small end.

Mr Gordon, Glasgow and West of Scotland Agricultural College, exhibited photographs illustrating very useful methods of eradicating bracken.

Mr Wm. Peffers, Electric Sawmills, Hawick, and Mr W. A. Edmond, joiner, Floors Castle, were each awarded Medals for exhibits illustrating utilisation of home-grown timber. Mr Peffers' collection included a complete rustic bridge; sections of pine flooring; rails sawn from crooked oak boughs; and a large pine log 40 feet long by 20 inches quarter-girth. Mr Edmonds' collection consisted of articles of turnery.

A remarkable collection of artificial flowers made from pine and spruce timber, for which a Silver Medal was awarded, was shown by Mr Charles Burton, Sandford Hill, Longton, Staffordshire. Most of the flowers were wonderful imitations of Nature's own production, and they attracted much attention.

Excellent arrangements for the staging and setting out of the material were made by the local committee, consisting of Mr Milne Home, Mr W. M. Price, Mr Leven and Mr Leishman.

Notwithstanding the inclemency of the weather on one of the days of the show, the forestry exhibition attracted a great deal of notice and was visited by very large numbers, and may safely be claimed to have fulfilled its purpose in assisting to educate public opinion, and to bring forward to public notice the aims and objects of the Society. J. F. A.

NOTES AND QUERIES.

Afforestation of Privately-owned Lands.

The Board of Agriculture for Scotland has issued the following memorandum outlining proposals for the afforestation of land in private ownership:—

"The Development Commissioners are prepared, within the limits of the funds available, and subject to Treasury sanction, to recommend advances to the Board of Agriculture for Scotland for approved schemes of afforestation of land belonging to private owners. In order that as much as possible of the available funds may be spent in actual planting, the Commissioners hope that landowners desiring their land to be planted may be willing to secure this by mutual arrangement under which the afforestable land will be leased to the Board on the principle that no return is to be paid for the use of the land until the proceeds of afforestation accrue, and that then these proceeds shall be divided between the landowners and the Board according to the proportion which the rental value of the land bears to the sum provided by Government for afforestation and maintenance. Any agreed contribution by the landowners to capital expenditure would be taken into account in the allocation of the proportion of proceeds, and also the present value of any growing timber crop included in the leased area.

"It might be convenient that this proportion should be fixed at the outset according to the present value of the land-rental, and of other contributions which the landowner might desire to offer, on the one hand; and, on the other, to the sum estimated to be necessary for the afforestation of the area, and to the present value of maintenance charges during the first forest rotation so far as provided by Government.

"All land leased on a proceeds-sharing basis will be held for periods to be adjusted with the Government Department concerned as lessees. It will be dealt with under the prescriptions of a working-plan compiled by the Department in consultation with the owners, and at the termination of the period of such lease the landowner will be under obligation either to purchase the Government share of the standing crop or to continue the lease. In this connection the value of immature crops

might be adjusted by the repayment of capital expended on the crop with 3 per cent. compound interest, while the mature crop would be taken over at its sale value as fixed by a valuator approved by both parties. The term "immature crop" might be taken to mean all crops which have not attained one-half the age of commercial maturity.

"Applications from landowners should be addressed to the Board of Agriculture for Scotland. Details of the area concerned should be clearly shown on Ordnance Survey sheets, and present rental values with public and parish burdens should be specified. Those offers will be given the preference which afford opportunity for leasing at the present time areas up to 1000 acres in extent, with the prospect of extending the leased area to 4000 or 5000 acres as afforestation progresses; but, owing to the great variation in local conditions, the Board of Agriculture will be prepared to receive communications from all interested parties and to discuss proposals generally in accordance with the above principles."

With reference to the above Memorandum the President has sent the following letter to the Secretary for publication:—

"*15th December* 1914.

"DEAR MR GALLOWAY,—

"The memorandum issued by the Board of Agriculture for Scotland and described by the Board as outlining proposals for the afforestation of land in private ownership, is, even for a skeleton, meagre and incomplete. We can recognise in it characteristics to which we have become accustomed in the Board's dealings with silviculture, and a single new note which deserves more careful examination than the space of a letter can afford. Let us run over the familiar features—

"1. The old device, with which the first paragraph begins, of taking cover behind the Development Commissioners, as if the Board of Agriculture for Scotland had no mind or will of its own in a matter of vital interest to the poorer parts of the country.

"2. The nervous horror of doing anything that may remotely and indirectly benefit landowners—well illustrated by

"3. The old old story that the landowner is to receive no rent for his land, and no return from it, until the sales of forest produce may begin—*i.e.* the weaker partner is to bear the whole of any loss of income that afforestation may entail.

"It is necessary to repeat, as often as this condition appears in the terms, that it is fatal to the development of afforestation in Scotland on any considerable scale—unless indeed afforestation is to be developed by the forfeiture of the elementary rights of individuals.

"So far we have been on ground familiar to the point of weariness. We are now told that the eventual division of the proceeds between the Board and the landowner is to be governed by the proportion existing between the sum provided by the Government for afforestation and the rental value of the land—and that applications from landowners should specify present rental values and public and parish burdens.

"Now the crux of afforestation is the discovery of the fair share of the whole rental and burdens to be borne by the afforested part of any area. The refusal of the Board to consider the question of compensation for loss of rental makes the question for the moment an academic one—but it must be kept steadily in view if any generally applicable solution of the afforestation problem is to be found, and it is only right to welcome the first sign of a wish on the part of the Board to examine this vital question of rental and burdens.

"After this ray of light, we return to darkness; there is a very significant omission from the Board's scheme, so important that it can hardly be due to carelessness. The Board ignores entirely the silvicultural value of the land. On the face of the proposals, the landowner will receive no more for the best larch land, as such, than for land only suitable for Scots pine. He will of course receive a larger sum from his share of the more valuable crop, but the Board's proposal ignores the owner's right to the silvicultural value of the land. Under the scheme as it stands the landowner who can afford it would be well advised to plant his better forest soil for himself, and leave the doubtful and bad to be dealt with by the Board.

"It is to be feared that these proposals will not greatly further the cause of afforestation, since they are only applicable, on the one hand, to land at present producing no rent, and, on the other, to landowners to whom the loss of rental involved in accepting them is no serious objection. In the present time of war, the loss of any opportunity of benefiting a part of the country largely deprived of its wage-earners, gives cause for deep regret. Planting is capable of giving a great deal of employment to women and

old men and young lads—now almost the only inhabitants of many Highland parishes, which have given to the King's service a proportion of men many times greater than the average proportion of the country.

"Yours very truly,

"ARCHIBALD STIRLING."

COLLECTION AND STORAGE OF FOREST SEEDS.

The Board has also issued a leaflet (No. 21) which deals with the collection and storage of forest seeds. Practical and useful hints are given concerning such matters as—source of seed, time of ripening, methods of collection, preliminary storage and extraction, permanent storage and testing. A handy table is added at the end, which gives information regarding time to collect and time to sow, depth to cover, and kind of storage suitable for the seeds of the more important forest trees, both broad-leaved and coniferous. Copies of this leaflet may be obtained, free of charge and post free, on application to the Secretary, Board of Agriculture for Scotland, 29 St Andrew Square, Edinburgh. Letters so addressed need not be stamped.

THE UTILISATION OF SMALL HOME-GROWN TIMBER.

The following important circular has been issued by the Board of Agriculture for Scotland:—

"The attention of landowners, factors, timber merchants and sawmill owners is called to the fact that at present the Director of Army Contracts (1B) War Office, Whitehall, London, S.W., is advertising for manufacturers to tender for the supply of the following articles made solely, mainly, or partly of wood:—

"Wooden tent poles, made of white deal (poles), elm (blocks); wooden tent pins, made of beech, ash or oak; wooden picketing pegs, made of ash; helves and handles, made of ash; dry cooperage (cask vat), consisting of deal (heads), oak (staves, battens, and cants); form and table tops, made of yellow or white deal.

"The tent poles are of two sizes—Mark III., 9 ft. 9 ins. long and $2\frac{1}{4}$ ins. in diameter, and Mark II., 11 ft. 10 ins. long and $2\frac{5}{8}$ ins. in diameter; the poles are made in two parts, joined by a socket, the parts in each case to be interchangeable.

"The blocks are cylindrical pieces of wood $3\frac{1}{4}$ ins. high by $4\frac{1}{2}$ ins. in diameter.

"The tent pins are $10\frac{1}{2}$ and 13 ins. long (to be cleft), or 20 ins. long and 3 ins. in widest part, while tent runners and triangular pieces are of smaller dimensions.

"The picketing pegs are 17 ins. long by $1\frac{5}{8}$ in. thick (full).

"The helves vary from 12 to 36 ins. long, some being round, others oval, and some straight and others curved.

"The cask vats are of various sizes, viz.:—

"1 ton, 1 in. thick, 41 ins. long in stave, 34 ins. diameter in head, and 41 ins. diameter in bilge. $\frac{3}{4}$ ton, 1 in. thick, 40 ins. long in stave, 29 ins. diameter in head, and $34\frac{1}{2}$ ins. diameter in bilge. $\frac{1}{2}$ ton, $\frac{3}{4}$ in. thick, 40 ins. long in stave, 25 ins. diameter in head, and 30 ins. diameter in bilge. $\frac{1}{4}$ ton, $\frac{3}{4}$ in. thick, 32 ins. long in stave, 22 ins. diameter in head, and 27 ins. diameter in bilge. The staves are to be made of cleft oak free from sapwood.

"The forms are 6 ft. long, $8\frac{3}{4}$ ins. wide, and $1\frac{1}{4}$ in. thick, with battens $2\frac{3}{4}$ by $1\frac{1}{2}$ ins.

"The tables are 12 ft. long, 2 ft. $5\frac{1}{2}$ ins. wide, and $1\frac{1}{4}$ in. thick when finished.

"The trestles are 2 ft. 5 ins. high, 2 ft. $5\frac{1}{2}$ ins. long, top 3 by $2\frac{1}{2}$ ins., legs $2\frac{1}{2}$ by 2 ins., battens 7 by 6 by $\frac{7}{8}$ ins.

"Copies of the specifications giving full details for each article needed can be obtained on application to the Director at the address given above.

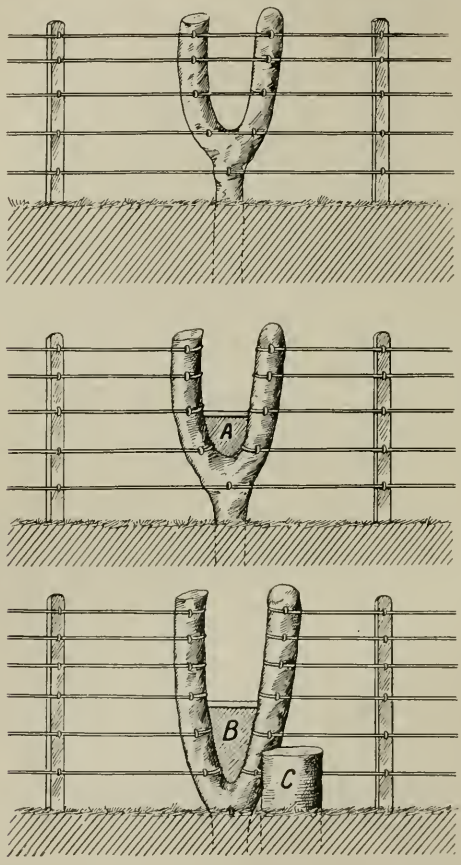
"Attention is drawn to the articles needed, as it is hoped that timber of the required kinds and dimensions may possibly be shaped in the rough at estate sawmills and workshops, if landowners, factors or timber merchants can be brought in touch with the manufacturers willing to enter into contracts with the War Office for the supply of any one or more of the articles mentioned.

"The benefits that may thus be secured to the country at large, and to the labouring classes employed in connection with working up the raw materal are self-evident."

A Useful Type of Stile.

I have found the device illustrated in the accompanying figures useful myself, and possibly it may prove convenient for foresters and others. To make a passage or gangway for

men through a wire sheep or cattle fence, I take a forked stem of a tree, as shown in Fig. 1, and sink it about 3 feet in the ground. I then fasten the wires tightly to the forked part by staples, and afterwards cut the wires, double them back round the forks, and drive more staples over the folded-



in ends. This gives a ready, simple and useful stile. One has to choose a fork which will keep out a sheep or ox, and allow a man to pass through. One can vary or improve the stile at will—(1) by putting in a block A (Fig. 2) and spiking it down; or (2) by putting in a higher block like B (Fig. 3), and other logs (C) to act as steps to the stile. In the last case a rabbit wire-netting can be added.

Lt.-Col. MARTIN-MARTIN.

Re-introduction of Scots Pine (*Pinus silvestris*) into Southern England.

The period at which this took place is frequently given as the last quarter of the eighteenth century; for instance, the date named for the New Forest, Hampshire, is 1776. This general statement seems to require some qualification, and the following four cases may be cited of earlier dates:—

1. On Hampstead Heath the trees called "the Firs," so often figured in local views, are of this species, and there is documentary evidence that they were planted in 1734.

2. The large plantation called the "Evergreens," in Woburn Park, Bedfordshire, was planted in 1743, and there were Scots pines in it which had attained the height of 55 feet and girth of 13 feet at 4 feet from the ground previous to 1839 (*Pinetum Woburnense*, 1839, p. 7).

3. At Stratton Strawless, near Norwich, in 1748, R. Marsham planted some of his "Waste" partly with Scotch firs, as he names the trees (T. Bell's edition of Gilbert White's *Nat. Hist. of Selborne*, vol. ii. p. 267, 1877).

4. White himself says, in an entry under the date of 24th October 1766, that at Selborne "the Scotch pine casts its leaves of last year" (*A Nature Calendar*, by W. M. Webb, Selborne Society, 1911).

There are also instances of early planting as an ornamental or park tree, such as at Heron Court, near Bournemouth, where a group of four Scots pines on the south lawn are said to have been grown from seed brought from Scotland in 1746.

These widely separated localities indicate that there had been considerable planting done previous to 1750.

Hugh Boyd Watt.

Abnormal Growths on Willow Trees.

There is a curious and unusual growth on some of the willows on Hampstead Heath, Middlesex, which was first noticed two years ago and has continued abundantly since then. Externally it resembles the familiar "Witch's Broom" found on birch trees, but is not so large or bunchy, seldom exceeding the size of an average turnip, and in shape it is more frequently elongated than rounded. Some trees look as if their upper branches were occupied by a colony of rooks' nests in miniature, a kind of

doll's-house-rookery, and dozens of examples of the growth occur on single trees. In the spring the fresh growths are greenish in colour, like the foliage, and as they dry up and wither they change to brownish, ending by becoming almost black in the rather smoky atmosphere. They persist and remain on the trees throughout the winter, conspicuous and eye-arresting objects. They occur on at least four different species of willows, namely, *Salix babylonica*, *S. alba*, *S. fragilis*, and *S. vitellina*.

It is apparently a case of phyllody; and Mr N. E. Brown of Kew Gardens, to whom I submitted specimens, writes that the branches show "modified female catkins, in which the female flowers are transformed into a more or less leafy state, where each flower becomes an aborted leafy shoot. Some of the carpels are modified into an expanded leaf at the base of a partly enclosed rudimentary leafy axis, and some are much enlarged carpels, containing a small leafy axis bearing two or three minute leaves inside. There is no disease apparent. It is a very interesting modification." At Mr Brown's request, further specimens were sent to the Director at Kew for the herbarium there, and a later report from this authority says—"The hypertrophy of the willow catkins received is possibly caused by a mite, as these creatures were found on the older diseased pieces. In the older stages the twigs have become greatly swollen, and adventitious flowers formed in great number from the tissues."

This still leaves the cause of the malformation an open question, but it seems probable that it is due to a gall-mite of the genus *Eriophyes*. In the Forestry Museum, Kew Gardens, there is a specimen labelled *Eriophyes fragilis*, looking very like the Hampstead growths. I am told that another species, *E. tri-radiatus*, attacks both *S. alba* and *S. fragilis*, and that *E. rudis* has a partiality for birches. Messrs Elwes and Henry [1] refer to "Witch's Broom" on the white willow (*S. alba*), apparently formed by irritation set up by *Eriophyes salicis*, but the description given by them of the resultant growth differs from what is found on the Hampstead trees.

As so little seems to be known about these abnormalities on willows, any further information would be useful.

HUGH BOYD WATT.

[1] *Trees of Great Britain and Ireland*, vol. vii. p. 1761.

THE JANKER CART.

To face p. 117.]

The Janker Cart.

(With Plate.)

This cart is very useful for the transport of heavy logs of timber, and may be drawn by either one or two horses according to the weight of the log. Most of our large timber was formerly moved with either an ordinary timber cart or with a pole janker. The janker cart possesses much simplicity and ease of handling, and has the advantage over a pole janker that an inexperienced man can lift very large logs of timber alone.

On the other hand, however, in its original form the janker cart is not so useful as the pole janker for the removal of long timber. As a general rule its limit for length is about 18 feet.

The illustration (Plate X.) shows the cart in use in this form, but it can be readily transformed into a pole janker by the removal of the shafts and fittings, and substituting a suitably mounted pole on the axle. The cart consists of ordinary janker wheels and axle with two shafts over the axle similar to an ordinary wood cart. It will also be observed that on these shafts — in front and behind the axle—are fixed two steel bows which form part of the same circle as the axle. Through these bows pass two powerful screws, and to these the chains used for lifting the wood are fastened. For the conveyance of heavy logs of timber under 18 feet in length, the cart is superior to the pole janker.

A. Murray.

Home-Grown Pitwood.

As stated by Mr Milne Home in his important article on "The Home Pitwood Supply," the Forestry Branch of the Board of Agriculture for Scotland foresaw, immediately on the outbreak of war, that there was a possibility of our supplies of pitwood, especially those from the Baltic, being seriously reduced, if not entirely stopped. The first thing, therefore, to be done, was to ascertain the supplies required to keep the mining industries going, and to see how far these could be met by the utilisation of home-grown timber. The result of these prompt inquiries was to indicate that, with proper organisation, the necessary supplies could be obtained from our home forests for at least a year. A Committee, representative of all the interests concerned, was appointed to deal with the whole question, including the supply of labour. An important

result of one of its early meetings was that the coalowners agreed to accept any species of timber, with the exception of beech, whether seasoned or freshly felled. The Committee recommends the following sizes to producers and consumers:—

Round Props or Bars.		
Diameter at small end.	Short Props.	Long Props.
2 inches.	2 feet to 2 feet 9 inches.	...
2½ ,,	2 ,, 4 ,, 6 ,,	...
3 ,,	2 ,, 6 ,,	12 feet to 14 feet.
3½ ,,	3 ,, 7 ,,	12 ,, 14 ,,
4 ,,	3 ,, 9 ,,	12 ,, 14 ,,
4½ ,,	4 ,, 10 ,,	...
5 ,,	4 ,, 12 ,,	12 ,, 14 ,,
5½ ,,	5 ,, 12 ,,	...
6 ,,	5 ,, 12 ,,	...
7 ,,	6 ,, 12 ,,	...
8 ,,	8 ,, 9 ,,	...

It was fully recognised that the crux of the whole question was the incidence of railway rates, and in the interests of all parties it was decided to move for a substantial reduction in the existing rates.

Mr Sutherland, on behalf of the Board, undertook to represent the case, and to arrange for a deputation of the whole Committee to appear before the Secretary for Scotland, in London. After this visit it was proposed that the Deputation might proceed to the Board of Trade Offices to make further representations there. The meeting took place on the 22nd of September last, and at the Offices of the Board of Trade its members were received, in company with representatives of the Scottish Railway Companies, the Government Railway Executive Committee, representatives of English forestry and other interests, by the President of the Board of Trade, Mr Runciman, who, after the case had been put by the Deputation, promised to give the matter immediate consideration. The Secretary for Scotland was present at the conference at the Board of Trade, and his assistance at the deliberations was greatly appreciated by the Deputation.

The result of the Deputation was that the Scottish Railway Companies agreed to modify the rates quoted for pitwood consigned direct to Scottish collieries from timber-growing centres in Scotland, so that the maximum rate will not exceed

10s. per ton, for timber not exceeding 14 feet in length. The existing rates under 10s. per ton will be maintained. The modified rate will be extended to through traffic of pitwood between stations on the Caledonian, Glasgow and South-Western, North British, and Highland and Great North of Scotland railways. Endeavours are now being made by the Board for an arrangement between Scottish, English and Welsh railway companies for through rates for pitwood from Scotland to England and Wales, as there is a demand in England and Wales for Scottish pitwood.

It is to be hoped that, in the interests of Scottish forestry, the Board of Agriculture for Scotland will shortly make available to growers the large amount of valuable information which has been collected during these inquiries. The increased demand for home-grown pitwood will, no doubt, lead to a considerable increase in the area of woodland which is normally cut in this country, and while it is highly important that the necessary supplies should be forthcoming through these increased cuttings, it is equally important that the areas cut should be replanted without delay. It is, however, understood that the Board have this matter under consideration.

In connection with the general subject, we have to note that the Board of Agriculture and Fisheries have recently issued a comprehensive report on the Supplies of Home-grown Pitwood. An inquiry into the whole subject as regards England and Wales was undertaken by the Board's Forestry Branch with the assistance of the Forestry Advisory Officers, under the supervision of Mr R. T. Robinson. After careful investigation of the whole question the position is described as by no means disconcerting since, with rational handling, supplies sufficient to last for 1½ years can be obtained from home sources. Special leaflet No. 17, on Supplies of Pit Timber, was also recently issued by the same Board. Both leaflet and report are of great importance at the present time, and should be carefully studied by all foresters.

REVIEWS AND NOTICES OF BOOKS.

Hardy Trees and Shrubs in the British Isles. By W. J. Bean, Assistant Curator, Royal Botanic Gardens, Kew. Two volumes, 1440 pp., with over 250 line-drawings and 64 half-tone illustrations. Price £2, 2s. net. London: John Murray.

These comprehensive volumes, which reached us as we were about to go to press, appear to be the lineal successors of Loudon's great work published seventy-six years ago. The author points out that in the interval the number of species introduced to cultivation has probably been doubled, and that in the present volumes about 2800 species (besides numerous varieties) have been described, including nearly 400 of the new Chinese trees and shrubs introduced within the last fifteen years. We hope to return to this book again in a future issue.

Trees: A Woodland Notebook containing Observations on certain British and Exotic Trees. By the Right Hon. Sir Herbert Maxwell, Bt., F.R.S., LL.D., D.C.L. Illustrated with photographs by Mr Henry Irving and others. 21s. net. Glasgow: Maclehose & Sons.

This delightful book consists of thirty-four articles or essays, each of which is devoted to a single tree or species. The trees selected are those indigenous to the United Kingdom, and exotic species which have proved, or are likely to prove, suitable to the British climate. The papers, which originally appeared in the *Scotsman*, aroused a great deal of public interest, and we hope there will be a large demand for them in this permanent form. While the author professes that his aim is not to present either a scientific botanical treatise or a manual of technical forestry, the reader will find that a considerable amount of botany and forestry has been imparted to him in a most agreeable manner. The author's method is to give information as to the general distribution of the particular tree he is dealing with—

the places where the best specimens are to be seen; the proper methods of its cultivation; the kind and value of the timber produced; and other particulars such as the effect of the tree on the landscape, and the place names that have been derived from it. All this is so deftly interwoven with anecdote and story, that the reader is almost unaware that he is being led on to take an interest in the great subject of forestry. The book contains fifty-seven illustrations, eighteen of them coloured, which add much to the charm of the work. The upmake of the book is all that could be desired—the paper, printing, illustrations and binding being alike excellent.

Physiography of the United States and Principles of Soils in Relation to Forestry. By Professor ISAIAH BOWMAN. xxii + 759 pp. Price 21s. net. New York: J. Wiley and Sons; London: Chapman & Hall, Ltd., 1911.

A knowledge of the physiographic features of a country is of the utmost importance to all students of forestry. Topography, drainage, soils and climate must be studied in order that the forester may realise their intimate bearing on the whole question of tree-growth and forest utilisation. As the author points out in his preface, "It seems so clear that one cannot know forestry without knowing under what physical conditions trees grow, that one finds it impossible to see how even the least philosophical view of the subject can exclude a knowledge of physiography. It would seem that one should pay a great deal of attention to lumbering as related to drainage and relief, to silviculture as related to soils, climate and water supply, and in general that one should emphasise the forester's dependence upon physical conditions. This would appear to be so plain a doctrine as not to require restatement here, were it not for the fact that some students of forestry and even some schools of forestry still pay too little attention to the subject. If the forest is accepted merely as a fact, and the chief concern is its immediate and thoughtless exploitation, physiography may be indeed the fifth wheel to the coach, although even so practical a view as the lumberman's must include some knowledge of topography and drainage if merely to put forest products on the market. But forestry is more than lumbering, and if forests are to be conserved,

if they are to be improved and extended, every direct relation of the tree to its physiographic environment is vital."

The book is divided into two parts. The first part, which deals with soils, is devoted to a very full consideration of their origin and diversity together with their physical and chemical features, while a description of the classification of soils completes the part.

Although not a treatise on forestry the book is one which should be read by all students of forestry, as it deals with matters which are of fundamental importance to forestry in all its aspects. As might be expected, the enormous influence of forests on soil conservation, drainage and water supply is brought prominently before the reader.

In maintaining the soil, and preserving and regulating the water supply, the forest comes first in importance of all the means which man can adopt to that end. The author points out that the rapidity of erosion is, in many places, a matter of grave concern. Over twenty years ago an estimate by Shaler showed that in America about 4000 square miles of country had been impoverished through wasteful agricultural methods, representing a loss of food resources sufficient to support a million people; and that at least 5 % of the soils which at one time proved fertile under tillage "are now unfit to produce anything more valuable than scanty pasturage." The author then goes on to say, "To us of a later generation this figure appears gratifyingly small beside the figure that would express the deplorable ruin of the past quarter century of reckless timber cutting and baneful neglect of fields abandoned by the upland farmer." An inference as to the powerful influence of the forest in preventing flooding and erosion may be drawn from a statement quoted from Fernow. "The forest litter, the moss-covered and leaf-strewn ground, is capable of absorbing water at the rate of from 40,000,000–50,000,000 cubic feet per square mile in ten minutes—water whose progress is delayed by some twelve to fifteen hours after the first effects of a heavy freshet have passed."

Deforestation or want of afforestation may not only lead to a loss of soil on the hill slopes and upland areas, but alluvial lands of the valleys and plains may also suffer serious soil deterioration through flooding. The question of proper forest management in hilly and mountainous countries is of the

greatest importance to the prosperity of present and future generations. We may quote the following and convincing paragraph from page 616 where, speaking of deforestation in the Appalachians, the author says, "The rain beats directly upon the soil, the retarding influence of the ground-litter and tree roots and trunks is withdrawn, and more rapid soil removal occurs. When once these evil effects have been allowed to take place mankind is deprived, practically for thousands and even millions of years, of the favourable conditions that preceded the epoch of destruction. In a hundred years man may achieve such baneful results as nature will compensate only during a geologic period of hundreds of thousands of years. Soil is a resource of priceless value. Many glacial striæ formed on resistent rock during the last glacial epoch, roughly 60,000–75,000 years ago, are still preserved as fresh as if they were made but yesterday. In that time man has come up from the cave and the stone hammer. Seventy thousand years is a very short time for the development of a soil cover; for man it means a period so great that his mind can hardly appreciate it. The earth as we find it in the geologic to-day must be treated with care if the human race is to have a fair distribution of its wealth in time. To the geologic mind there is something shocking in the thought that a single lumber merchant may in fifty years deprive the human race of soil that required 10,000 years to form."

A characteristic feature of the book is the lavish number of well-chosen and beautifully reproduced photographs, diagrams and maps. Many references to original sources of the literature bearing on the subject are given in footnotes, and a very useful and comprehensive index is given at the end.

The Artificial Production of Vigorous Trees. By AUGUSTINE HENRY, M.A., F.L.S., M.R.I.A. *Journal of the Department of Agriculture and Technical Instruction for Ireland*, vol. xv. No. 1.

If there had been no intervention by artificial means, and plants had been allowed to reproduce themselves naturally, it goes without saying that, chance hybrids excepted, to-day we would have had none of the useful food and other plants we possess, but only the weeds from which they sprang.

It would be idle to maintain that "new creations" are only now appearing among trees, and we know quite well that many such hybrid creations among flowers and fruits have long been in existence, although many of them have been obtained by most haphazard and often inexplicable ways. But, as Professor Henry remarks, "it is remarkable how little has this method been applied to the improvement of forest trees." Klotzsch commenced the work in Berlin in 1845, and in 1891 the Californian hybridist, Luther Burbank, obtained some truly remarkable results in rate of growth in the progeny of some of the walnut species which he crossed. In fact, Burbank seemed to believe that almost anything was possible in this way. "The possibilities of improvement in trees are so great," he said, "as to make it seem almost an exaggeration to state them," and he expressed the opinion "that one of the most important, in some ways the most important of all the many fields open now to the plant breeder, is this one of the production of new and the improving of old trees," and that he believed it to be "of immense significance commercially."

From the results obtained by Professor Henry, it would almost seem that the possibilities adumbrated by Burbank were not overdrawn, so amazing are they. One of the most remarkable is a hybrid poplar (*Populus generosa*, Henry), a cross between the Carolina poplar (*P. angulata* ♀) and *P. trichocarpa* (♂), the female parent being one of the black poplars, and the male belonging to the balsam section of the genus. Plants of this hybrid raised from seed sown in June 1912 were from 2 ft. 11 ins. to 3 ft. 6 ins. high by the end of 1913, and two of them, which were not transplanted, and therefore not checked, were 7½ feet and 10 feet high respectively at the end of the growing season in 1914. The same female parent crossed with *P. nigra betulifolia* (the common European black poplar with hairy twigs) gave less vigorous seedlings (the tallest plants being now 4 ft. 5 ins. and 3 ft. 8 ins. in height), strongly resembling in their characters the black Italian poplar (*P. serotina*) and the Eucalyptus poplar (*P. regenerata*), hybrids of similar origin which were produced accidentally in France many years ago, and which Professor Henry says are now "the most common poplars in cultivation." Many other hybrids have been produced between species of ash, alder, elm, larch, cypress and beech, and even crosses between species of different genera—

Fagus sylvatica × *Quercus pedunculata*, *Quercus pedunculata* × *Juglans nigra*, *Quercus pedunculata* × *Fagus sylvatica*, *Quercus pedunculata* × *Juglans regia*—have been attempted in 1914. Bi-generic hybrids are unlikely to be produced among trees, but when one looks to the amazing results which have been obtained in this way among orchids and a number of other plants, it would be foolish to express any decided opinion until the experiments have been carried further.

One difficulty there is with these hybrids as subjects for forestry. In the cases of hybrid willows and poplars, which are usually propagated by cuttings, there is no difficulty in multiplying the individual plants to any desired extent, and even in the case of elms layering as a method of vegetative reproduction might be resorted to; but there are some kinds which cannot be propagated so easily as these, in which budding or grafting must be practised, and they are therefore useless to the forester. Seed, even when it is produced, will not give an exact reproduction of the parent.

The cause of the extraordinary vigour of first crosses is obscure, and Professor Henry does not attempt an explanation of it. He suggests it as possible that "the stimulus which causes growth (*i.e.* cell-division) to commence and to continue is some soluble chemical compound or enzyme," and that "the enzyme in the hybrid may be more complex and more effective than the enzymes in the species."

What Professor Henry has to say about the association of the vigour in the hybrid with the degree of relationship between the parents is interesting. "Whether," he says, "the amount of vigour in hybrids is directly associated with the degree of relationship between the individuals which are crossed is a disputable point, but one of practical interest in the selection of parents for crossing experiments. One of my most vigorous hybrids (*Populus generosa*) is derived from two parents so little related that they are placed in two distinct sections of the genus. A cross between two races of the common alder shows considerable vigour, though the parents are so closely allied that they can only be distinguished by the most trivial characters. The fact, if established, that different races when crossed give vigorous progeny, should be turned to practical account in plantations and forests where natural regeneration is looked for. The introduction of a few lines of the Riga variety into a plantation

of native Scots pine might ultimately, as pollination would be effected by the wind, give seedlings of enhanced vigour."

The experiments are of great silvicultural value, and as Professor Henry mentions that his "main object, which was to show that novel and valuable trees could be artificially made, is now achieved; and that there is a possibility of similar work on commercial lines being undertaken by enterprising firms," we may expect to hear more about the matter ere long.

A. D. Richardson.

OBITUARY.

Dr John Nisbet.

By the death of Dr John Nisbet, Forestry Adviser to the Board of Agriculture in Scotland, which took place on the 30th November last, at St Mary's Lodge, Exmouth, the Society has lost a valued and honoured member. Dr Nisbet was a pioneer, and one of the ablest exponents, of scientific forestry in the United Kingdom. To him more than to anyone is due the progress, little though it be, we have made towards a rational appreciation of our responsibilities in the way of growing timber for profit.

Born in 1853, John Nisbet was educated at the Edinburgh Institution and University. Thence he passed into the Indian Forestry service in 1875. Studying at Munich during his training, he took the degree of Doctor in National Economy, and, as the favourite pupil of Gayer, acquired a profound knowledge of the science of forestry, which he carried with him into his Indian service, from which he retired in 1900, after reaching the rank of Conservator. Routine work, however telling, in official service is known to but few, and Nisbet's contribution to the development of Indian forestry is merged in the merit of the Department. In recognition of this he was decorated with the Kaiser-i-Hind gold medal for public services in India at the Delhi Durbar, 1903.

We in this country might have heard little, if anything, of him had he not foreseen that the growing timber consumption of the world, the reckless destruction of timber in virgin areas, and the inadequate response of this country in the way of future supply, were factors of a timber famine which must come upon Great Britain unless timely steps were taken to improve its forestry. Early in the nineties of last century, whilst still in the Indian Service, Nisbet, gifted with a ready and instructive pen, began to approach the public by lectures, by articles in magazines, and by text-books of forestry, in his endeavour to stir up interest in the problem of timber supply and scientific forestry. Among his more important publications are *British Forest Trees* (1893), *Protection of Woodlands* (1893), *Essays on Silvicultural Subjects* (1893), *Studies in Forestry* (1894), *Burma under British*

Rule (1901), articles on forestry in the *Victoria History of the Counties of England* (1903-1907), *The Forester: a Practical Treatise on British Forestry and Arboriculture* (1905), *Our Forests and Woodlands*, second edition (1908), and *The Elements of British Forestry* (1911). His was, however, a "cry in the wilderness." For long he met with little support. Nowadays, when the appreciation of timber is making itself felt, when the politician has found in forestry an aid to his cry of "back to the land," and when development schemes and the foundation of professorships and lectureships and Schools of Forestry are attracting attention, we realise that the importance of the timber question is being recognised. To Dr Nisbet we owe the awakening. There was a time, on the retirement of Dr Somerville from the Lectureship on Forestry in the University of Edinburgh, when, had Dr Nisbet been within hail, he might have been successor. Later, after his retirement from India, he became Professor of Forestry in the West of Scotland Agricultural College, retiring in 1912, when he joined the Board of Agriculture for Scotland as its Chief Forestry Adviser. To this Board his death brings a heavy loss. Dr Nisbet's long and active interest in and association with forestry gave him a broad outlook on all matters pertaining to the subject, and all the more important Government commissions and committees on forestry which have sat within recent years have benefited by his wise and judicious counsel.

Dr Nisbet was for long closely associated with the work of the Royal Scottish Arboricultural Society, and acted for several years as Hon. Editor of its *Transactions*. He also contributed many original articles of great value to the pages of that journal. On the occasion of the Diamond Jubilee celebrations of the Society, Dr Nisbet was singled out, along with Sir Ronald Munro Ferguson and a number of distinguished British and foreign foresters, to receive the Honorary Membership of the Society, which is the highest honour it has to bestow. On that occasion the President (Captain Stirling) said, in reference to him:—"The last name, but by no means the least on the list, is that of Dr John Nisbet, Forestry Adviser to the Board of Agriculture for Scotland, who, I think, by the very able books he has written on the subject, was the first to arouse any very widespread interest in scientific silviculture in Scotland."

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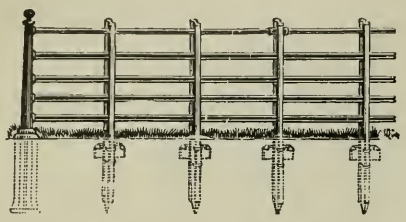

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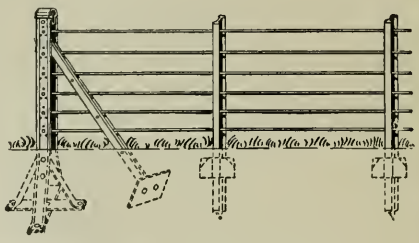

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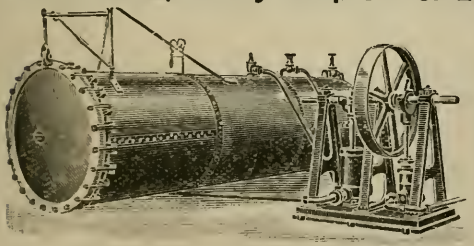

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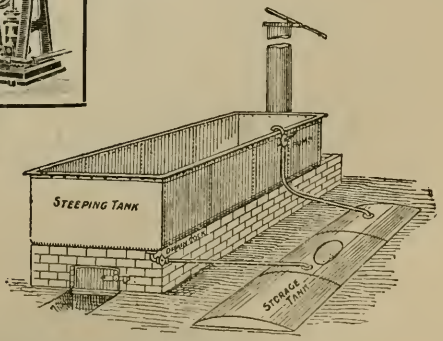

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The Society offers Annual Prizes and Medals for essays on practical subjects, and for inventions connected with appliances used in Forestry. Such awards have been granted continuously since 1855 up to the present time, and have yielded satisfactory results. Medals and Prizes are also awarded in connection with the Exhibitions and Competitions for Plantations and Estate Nurseries aftermentioned.

School of Forestry, Afforestation, Etc.

In 1882 the Society strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

In 1890, the Society instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. The Society also drew up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland, which was laid before the Departmental Committee on British Forestry, and in their Report the Committee recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government, in 1907, acquired the Estate of Inverliever in Argyllshire; and while this cannot be looked on as a Demonstration Forest, it is hoped that it may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. Meantime Sir Ronald Munro Ferguson, for a part of whose woods at Raith a Working-Plan is in operation, very kindly allows Students to visit them.

After the Development Act came into operation, the Council passed a Resolution urging that the Government should create a Board of Forestry, with an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting. The Society's policy for the development of Forestry in Scotland has since been fully laid before the Development Commission. As a result of these representations, the Secretary for Scotland appointed a Committee to report regarding the acquisition and uses of a Demonstration Forest Area, and any further steps it is desirable to take in order to promote Silviculture in Scotland. The Committee reported in the beginning of 1913, and the Society is pressing the Board of Agriculture for Scotland, being the Department now concerned with Scottish forestry, to give effect to the Committee's recommendations and to encourage the inception of schemes of afforestation. The Society has also published a valuable Report on Afforestation—including a Survey of Glen Mor—prepared for it by Lord Lovat and Captain Stirling, which, it is hoped, may form the basis of the general Forest Survey advocated by the Society.

Resolutions in favour of the acquisition of part of Ballogie, on Deeside, and Supplementary Areas in other districts for Demonstration purposes, and of the creation of a Department of Forestry for Scotland with a separate annual grant, were passed at the Annual Meeting in 1914.

In connection with the celebration of the Society's Diamond Jubilee last summer, representative Foresters appointed by the Governments of Denmark, France, Holland, Hungary, Russia, Sweden, India, Canada, New Zealand, and South Africa visited this country as guests of the Society. Accompanied by a number of home representatives they made a Tour of Inspection, extending to about a fortnight, of woods and afforestable lands in Scotland, and at the Conference held in Edinburgh before leaving, they expressed the joint opinion that Scotland lends itself admirably to afforestation on a large scale, and that national support should be given to the movement. A copy of the Report of the proceedings containing their Resolution, and also the Society's Resolution adopting it, was sent to Ministers and Government Departments and to all Members of Parliament for Scottish constituencies.

Excursions.

Since 1878 well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, Ireland, and the Continent. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, in 1904 the Forest School at Nancy and Forests in the north of France were visited, in 1909 a visit was undertaken to the Bavarian Forests, and during the summer of 1913 ten days were spent in the Forests of Switzerland. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, and Prizes and Medals are offered for Special Exhibits. In addition to this Annual Exhibition, large and important Forestry Sections organised by this Society were included in the Scottish National Exhibition held in Edinburgh in 1908, and in the Scottish Exhibition of National History, Art, and Industry, held in Glasgow in 1911.

Plantations and Estate Nurseries Competitions.

Prizes are now offered annually for the best Young Plantations and the best managed Estate Nurseries within the Show District of the Highland and Agricultural Society.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-nine volumes, are published half-yearly in January and July, and are issued *gratis* to Members.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the Honorary Officials mentioned above.

Local Branches.

Local Branches have been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

Consulting Foresters.

The Secretary keeps a list of Consulting Foresters whose services are available to Members of the Society and others.

Correspondents.

The following have agreed to act as Correspondents residing abroad :—

Canada, . ROBERT BELL, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa, late Chief Geologist to Government of Canada, Ottawa.

India, . . F. L. C. COWLEY BROWN, Principal, South Indian Forest College, Coimbatore, South India.

British East Africa, . EDWARD BATTISCOMBE, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, HUGH P. BAKER, Dean, New York State College of Forestry, Syracuse, N.Y.

Cape Colony, . W. NIMMO BROWN, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, FRED MOON, Craigian, Bighill Brook, Harren River, Manjimup.

New Zealand . R. G. ROBINSON, Department of Lands, State Forests Branch, Tapanui, Otago.

South Africa . K. A. CARLSON, Orange Free State Conservancy.

LOCAL SECRETARIES.

Counties.	*Scotland.*
Aberdeen, .	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyll, . .	H. L. MACDONALD of Dunach, Oban.
Ayr, . .	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick, .	WM. MILNE, Foulden Newton, Berwick-on-Tweed.

Counties.	
	Scotland.
Bute,	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, retired Forester, Barone, Rothesay.
Clackmannan,	Robert Forbes, Estate Office, Kennet, Alloa.
Dumfries,	D. Crabbe, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. Curr, Factor, Ninewar, Prestonkirk.
Fife,	Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.
	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	James A. Gossip, Nurseryman, Inverness.
Kincardine,	John Hart, Estates Office, Cowie, Stonehaven.
Kinross,	James Terris, Factor, Dullomuir, Blairadam.
Lanark,	John Davidson, Forester, Dalzell, Motherwell.
	James Whitton, Superintendent of Parks, City Chambers, Glasgow.
Moray,	D. Scott, Forester, Darnaway Castle, Forres.
Perth,	John Scrimgeour, Doune Lodge, Doune.
Ross,	Miss Amy Frances Yule, Tarradale House, Muir of Ord.
Roxburgh,	John Leishman, Manager, Cavers Estate, Hawick.
	R. V. Mather, Nurseryman, Kelso.
Sutherland,	Donald Robertson, Forester, Dunrobin, Golspie.
Wigtown,	James Hogarth, Forester, Culhorn, Stranraer.
	H. H. Walker, Monreith Estate Office, Whauphill.
	England.
Beds,	Francis Mitchell, Forester, Woburn.
Berks,	W. Storie, Whitway House, Newbury.
Derby,	S. MacBean, Estate Office, Needwood Forest, Sudbury.
Devon,	James Barrie, Forester, Stevenstone Estate, Torrington.
Durham,	John F. Annand, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	Thomas Smith, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. Cowper, Gortanore, Sittingbourne.
Lancashire,	D. C. Hamilton, Forester, Knowsley, Prescot.
Leicester,	James Martin, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. Havelock, The Nurseries, Brocklesby Park.
Notts,	W. Michie, Forester, Welbeck, Worksop.
	Wilson Tomlinson, Forester, Clumber Park, Worksop.
Surrey,	John Alexander, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. Christie, Hillside, Castle Road, Warley, Birmingham.
Wilts,	Andrew Boa, Land Agent, Glenmore, The Avenue, Trowbridge.
York,	George Hannah, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin,	A. C. Forbes, Department of Forestry, Board of Agriculture.
	Arch. E. Moeran, Lissadell, Stillorgan Park.
King's County,	Wm. Henderson, Forester, Clonad Cottage, Tullamore.
Tipperary,	Alex. M'Rae, Forester, Dundrum.

Royal Scottish Arboricultural Society

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member . . . . . .

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

19. Aerial Railway erected on the Lovat Estate, Inverness-shire.

(*With Plates.*)

By Gilbert Brown, Wood Manager, Strathspey.

The wire ropeway at Farley, near Beauly, was erected by Lord Lovat in 1907, for the purpose of bringing manufactured timber from Farley Forest to a specially constructed siding near Beauly railway station.

The area under wood at Farley before the commencement of operations was 1400 acres—the crop consisting of Scots pine and larch of from 60 to 70 years of age. The various lots have, up to the present, been purchased by Mr Frank Sime, timber merchant, Beauly, who has taken a personal interest in the working of the ropeway.

The roads leading from the sawmills to the railway are unsuitable for heavy traffic. Originally they had been constructed for the use of the crofters in the district. They are very rough and steep in some places, with a soft subsoil. They are also of a very zig-zag nature—the length of the road from the forest to the station siding extending to over three miles. It was desirable therefore that some method of transport other than ordinary road haulage should be adopted.

Two alternative schemes were considered—(1) the construction of a light railway; (2) the building of an aerial ropeway. From the general contour of the ground—the steep, short slopes and declivities, the public roads to be crossed and the large area of arable land to be traversed—it was considered that the latter method of transport would be the more suitable.

As the cost of erecting a ropeway is considerable, it can only be deemed practicable where the felling area is large. In Farley Wood most of the timber was mature. It was considered that the cutting would occupy at least eight years with two sawmills steadily employed. The length of ropeway required was one

mile. The upper terminal (Plate XI. Fig. 1) was so placed that timber could be easily conveyed to it from all parts of the forest. The cost of conveyance by the ropeway to the railway is 10d. per ton, whereas by cartage it is 2s. 9d. per ton. Not only is there this saving in expense, but the expedition by which the wood can be sent to market is a very material consideration. A ton is conveyed by the ropeway in ten minutes; by road it would take two hours. All questions of excessive damage to roads are also avoided. The saving effected in money and time has more than compensated for the initial outlay entailed in the erection of the ropeway.

The working of the ropeway.—The principle is quite a simple one. Loaded and empty carriers travel down and up on two main fixed steel ropes, partly by steam and partly by gravitation. The carriers are controlled by an endless hauling rope $\frac{5}{8}$ inch in diameter, which runs on pulleys below the fixed ropes, and is kept in check by the sawmill engine, a powerful brake strap, and a large grooved wheel at the top terminal. The fixed ropes are $1\frac{1}{8}$ inch in diameter, and are kept taut by an immense concrete anchorage at the top, and by concrete blocks weighing 9 tons each at the foot. The hauling rope is kept reasonably tight by means of a winch and concrete blocks weighing 2 tons. These also keep the rope taut, as it stretches from time to time by change of temperature or usage. The ropeway between the top and lower terminal (Fig. 2) is about 1770 yards in length, the distance actually travelled by the carriers being about 10 yards less. The ropes are supported by fourteen trestles, exclusive of the two terminals, to which are attached pulleys for the hauling rope and the saddles for the fixed rope.

The trestles vary, according to the configuration of the ground, from 25 to 60 feet in height, and occur at intervals of from 140 to 200 yards.

The unreeling of the ropes commenced from the bottom of the line, the hauling rope weighing 3 tons first, and the fixed ropes weighing each 5 tons last. The ropes are hauled by the aid of horses; block and tackle were utilised in the case of the heavy ropes.

The carriers (Plate XII. Fig. 3) consist of two curved wrought-iron hangers, on which a timber floor or bottom is laid. Four sides can be attached, forming a box for the conveyance of smaller timber, or for the transport of coal and other materials

FIG. 1. UPPER TERMINAL OF ROPEWAY, SHOWING LOADED CARRIER AND SAWMILL.

FIG. 2. LOWER TERMINAL OF ROPEWAY, LOADING BANK AND SIDING.

[*To face p.* 130.

FIG. 3. CARRIERS PASSING MID-WAY.

FIG. 4. VIEW OF ROPEWAY FROM RAILWAY.

to the upper terminal. The weight of the load does not exceed 22 cwts., and although it is possible to send down rough logs the work is confined to the transport of sawn timber of different sizes.

As already stated, the trestles (Fig. 4) vary in height from 25 to 60 feet, all the main beams being in one length set in concrete. The main timbers vary from 9 to 11 inches square; ties and braces from 6 to 9 inches by 3 inches; top bearers 10 by 6 inches. The timbers are of Scots pine, as it was calculated that the life of this timber would be sufficient to see the whole of the manufactured wood in Farley Forest removed. This has proved to be correct. To meet the requirements of the Board of Trade, guards had to be erected over the public roads.

The system is known as the fixed rope system. There is another with one continuous running rope to which carriers are affixed and are conveyed by the motion of the rope.

For the purpose of signalling, and regulating the transport of timber from terminal to terminal, a telephone is employed.

As the upper sawmill is situated about a mile from the upper terminal, a light railway (Plate XIII. Fig. 5) conveys all the manufactured timber to this point. It is also utilised for conveying rough logs to either of the mills. The railway is made on the general principle employed in woods, viz., with rails of light gauge fixed on light pit sleepers.

20. Mode of Infection of Larch Canker.

By Sir JOHN STIRLING-MAXWELL, Bart.

The January number of the *Quarterly Journal of Forestry* contains an article on this subject by Mr W. E. Hiley of the Research Institute, School of Forestry, Oxford, which deserves the attention of Scots foresters, or at least of those who are prepared to believe that the canker fungus found on the dead branches is the same which attacks the living tissue.

Mr Hiley starts with the assumption (which he undertakes to prove in a future article, but which few foresters will dispute) that the young shoots are not liable to attack until the first year's growth is complete. Next he discusses the various methods of infection to which the shoots may fall victims in their second year, but dismisses such attacks as relatively unimportant, since the side branches of the larch die quickly and the main

shoot, if affected early, is usually killed and replaced by a lateral. He then turns to the really important part of his subject, namely, the origin of the more destructive cankers on the main stem.

Mr Hiley bases his remarks on the examination of a large number of cankers in trees cut down in Bagley and Tubney woods near Oxford at thirteen to eighteen years of age. In the large bulk of cases he has found two important features:—

1. The cankers had been initiated at the bases of lateral branches.
2. The cankers were initiated when the portion of the stem on which they appeared was from three to eight years old. (The age was computed by counting in each case the number of unbroken rings inside the canker.)

He further found that in twenty-one out of twenty-six cases examined the canker had been initiated one or more years after the lateral branch died. In the remaining five cases the canker was initiated during the same winter as that in which the branch died.

Since for some time after death the canker fungus usually flourishes in the bark of the dead branches, Mr Hiley finds it difficult to resist the conclusion that the fungus is identical with that which attacks the living growth and finds its way from the lateral branch to the main stem.

It is true that the tree protects itself by forming, as the branch dies, a layer of cork which extends all round the branch near its base, turning inwards and so uniting the cork envelope to the woody centre and covering in the cortex and phloem which would otherwise be exposed. But Mr Hiley thinks that the fungus makes its entrance at the point where the new cork layer joins the wood. The space, he says, though narrow is frequently large enough, and though he has never been able to trace the hyphæ right through it, he has seen hyphæ at each end of it. He also thinks it possible, though less likely, that the fungus may effect an entrance through the wood itself which, until the dead branch decays, continues to project beyond the cork barrier.

Mr Hiley observes that if dead branches are, as he suspects, the chief source of canker, this new conception will suggest considerable modifications in the method of larch cultivation. He advises that experiments should be made in the removal of dead and suppressed branches. Since the knife exposes the

vulnerable tissues, Mr Hiley proposes that the branches should be cut during a spell of dry weather between January and March when the spores of the fungus are not being shed. They are only shed in a damp atmosphere. The experiment certainly seems worth making. In districts where dry spells are not to be depended on, a touch of Archangel tar would presumably protect the wound. Mr Hiley, however, remarks that in Bagley Wood where larches have been used as nurses for other trees and have had their side branches systematically shortened, no canker has appeared though the fungus is frequent on the cut branches on the ground.

The experiment as outlined by Mr Hiley is as follows:—

"When the trees are six to eight years old the lowermost branches are to be cut off, up to and including the oldest living branches, one half inch from the trunks. Each year in a spell of dry weather during the winter a fresh lot of branches is to be cut in such a way that every branch is removed at a time when it would have soon died naturally if left. After each cutting the branches should be collected and burnt so as to reduce the number of fructifications in the neighbourhood. If in bad canker districts foresters would treat plots experimentally, pruning half in the way I have described and treating the rest according to the older method, much evidence might be gained either in support of the theory I have outlined or against it."

Sir William Schlich has arranged for experiments on these lines in Bagley Wood.

Mr Hiley's paper seems to afford a possible explanation of the comparative immunity from disease of thinly grown larch woods. Hitherto this immunity has been attributed to the fact that abundance of space favours a vigorous growth in the larch while it tends to deprive the fungus of its favouring conditions. Is it also due to the fact that the side branches remain alive until the section of the stem from which they spring has passed the vulnerable age during which a canker imparted by a decaying side branch is a serious menace to the tree?

21. David Douglas.

By F. R. S. Balfour.

There is no botanist whose name should be more familiar to Scotsmen than that of David Douglas, associated as it is with the tree we all plant nowadays and know so well. Indeed it is no exaggeration to say that his introductions have furnished our woods and gardens, in Scotland at least, with most of the exotic trees and shrubs now in general cultivation, all of them brought from the North Pacific Coast where the conditions of climate are so like our own. To mention merely a few of the splendid conifers of that region which he introduced—*Tsuga Albertiana*, *Picea Sitchensis*, *Abies nobilis*, *Abies grandis*, *Abies magnifica*, *Abies amabilis*, *Pinus ponderosa*, *Pinus monticola*, *Pinus Sabiniana*, *Pinus Coulteri*, *Pinus insignis*, and that king of conifers *Pinus Lambertiana*, are perhaps those most familiar to us; and we can hardly imagine our shrubberies bereft of such plants as *Ribes sanguineum*, *Berberis aquifolium*, *Spiraea ariaefolia* and *Gaultheria Shallon*. It is curious that *Berberis nervosa*, so common on the banks of the Columbia, greatly preferred by Douglas to *Berberis aquifolium*, and introduced by him at the same time, is now one of the rarest shrubs in cultivation: the writer found it once at Traquair, where perhaps it has grown unnoticed with its commoner neighbour ever since Douglas' time.

David Douglas was born at Scone in 1798, and worked as a gardener for seven years on Lord Mansfield's estate, where many fine specimens of his trees can now be seen.

The Royal Horticultural Society, through the editorship of their secretary, the Rev. W. Wilks, assisted by Mr H. R. Hutchinson, have published the journals in which Douglas recorded his experiences from day to day during the expeditions made on behalf of that Society, first to Eastern America in 1823, and secondly from 1825–1827 in the country we now call Oregon and Washington, and during his long journey home across the Continent to Hudson Bay. The book[1] also includes a list of the plants introduced by him.

It is sad that we cannot also see his journals during the

[1] *Journal kept by David Douglas during his Travels in North America, 1825-27.* London: W. Wesley & Son, 1914. Price 21s. net.

second trip he made to the Pacific Coast in 1831, when San Francisco and Monterey were his headquarters for a year; he afterwards proceeded to the Sandwich Islands, from which he sent home his Californian collection. He left these islands for a second visit to the Columbia River in 1832, and made an expedition into the Puget Sound and Fraser River country, where Archibald Menzies in the Vancouver expedition of 1792 had already explored the shores of the innumerable inlets and described much of the flora. Of this expedition, in which Douglas was nearly drowned in the Fraser River, when he lost all his notes and his collection of 400 species, the editor makes no mention whatsoever; one cannot help regretting that Douglas' long letter of 6th May 1834 to Sir William Hooker, in which he described this disaster, was not published *in extenso* in the volume before us; it was the last of a long series that he wrote to Sir William Hooker, and is dated a few months before his death. I give it in full at the end of this article. Indeed these letters, all preserved in the Hooker correspondence at Kew, would, in the writer's opinion, have certainly formed by no means the least interesting part of this record. For instance, here is a description by Douglas of *Pinus Lambertiana* in a long letter to his friend, Dr Scouler, who had accompanied him on his voyage round Cape Horn to the Columbia River. He writes from Priest Rapids on the Columbia River on 3rd April 1826. "I am in possession of a species of *Pinus*, the finest of the genus. I hope soon to have abundance of better specimens and ripe seeds. It attains the enormous height of 170 to 220 feet; from 20 to 50 feet (65 erased) in circumference and grows remarkably straight; the wood is very fine, the cones measure 12 to 18 inches long. . . . Unquestionably this is the most splendid specimen of American vegetation. What would Dr Hooker give to dine under its shade; Mr Lambert could not eat anything if he saw it!"

These measurements of the Giant Sugar Pine, and those given in his journal of 26th October 1826 of the tree he found that day, 215 feet long, 57 ft. 9 ins. round at 3 feet from the ground and 17 ft. 5 ins. at 134 feet, are records of this tree which, as regards circumference, have never been surpassed. The writer, after seeing thousands of these immense pines in the hope of finding one to equal that of Douglas, had to content himself with photographing one of indeed well over 200 feet high, but

only 27 feet in circumference at 5 feet from the ground; this is the photograph reproduced in Elwes and Henry's great work.

It would have been much easier to follow Douglas' movements had a map been embodied in the volume with his journeys clearly traced in red ink; although the writer is familiar with most of the country traversed by him, a constant reference to maps greatly added to his understanding of the journal. It seems clear that on the long journey from Fort Vancouver to Hudson Bay his route lay through the Arrow Lakes, up the Columbia past Revelstoke, and north through the Yellow Head Pass—the route lately taken across the mountains by the Grand Trunk and Canadian Northern railways. Having crossed the Rockies by that pass he reached Edmonton after descending the Athabasca River. The Continental Divide was passed on 2nd May 1827 when snow was still deep in the mountains; had his journey been two months later what rich additions in alpines he might have added to the rock gardens of our grandfathers!

Although in the preface the editor says "the botanical names have been carefully looked up, and the modern name given to the plant inserted in a note at the foot of the page," one can only regret that these explanatory footnotes are so often wrong and so often omitted altogether. The modern names of species from the eastern side of the Continent are given in the footnotes with tiresome reiteration to Pacific Coast trees seen by Douglas; also when he mistakes the identification of a species in numerous cases no correcting note is given—instances are his record of *Pinus strobus* on the Arrow Lakes and *Pinus Banksiana* in the Rockies, the trees he saw being undoubtedly *Pinus monticola* and *Pinus contorta* respectively. *Abies balsamea*, *Picea nigra*, *Picea rubra*, *Picea alba*, *Tsuga Canadensis*, and *Quercus velutina* do not occur west of the Rockies, in fact the notes indicate an injudicious use of the *Index Kewensis*.

Where Douglas gives a description of a plant which makes it clearly recognisable, a footnote indicating the modern name would have been welcome; for instance, his tall alder on the Columbia (on page 106) is clearly *Alnus Oregona*, his *Cornus* (on page 109) "30 to 40 feet high with profusion of large white flowers" is *Cornus Nuttallii*, and the admirable description (page 222) of *Umbellularia Californica* leaves no doubt whatever of the identity of the tree described, yet there are no notes to tell us so.

Scotsmen may feel proud to read the names of their countrymen who explored and traded in that Columbia River valley long before it passed under the American flag; of Douglas' friends at the Hudson Bay Company's posts there is not one in five whose name does not clearly betray which side of the Tweed he came from.

Of Douglas' extraordinary death in the Sandwich Islands on 12th July 1834, a sad account is given by the two missionaries who looked after his body.

The journal is a record of hardships and privations cheerfully endured in his passionate enthusiasm of collecting; it is also a record of his immense success as a collector and of the indefatigable energy he devoted to his task.

The Royal Horticultural Society are to be congratulated on at last giving us the opportunity of seeing the whole journal in print, but the price might more reasonably have been 6s. than a guinea, and the book a more complete record of Douglas' life than it is.

Last letter of David Douglas to Sir Wm. Hooker, 6th May 1834.

"SANDWICH ISLANDS,
"*6th May 1834.*

"MY DEAR AND ESTEEMED SIR,

"I am two letters in your debt; for last autumn at the Columbia River I had the great pleasure to receive, through Dr Meredith Gairdner, a very long letter from you, and the same happiness was conferred on me on the 16th of April, by your last, which was exactly a year old, and in which you mention having addressed me just two months previously. I imagine this last letter must have been sent by Captain Back, or the annual express of the Hudson's Bay Company; but I had left the sea before the express arrived.

"My meeting with Dr Gairdner afforded me heartfelt satisfaction, not only because he is a most accomplished and amiable young gentleman devotedly attached to Natural History, and warmly recommended by you, but also because he told me of your health, and that of your family; the additions to your herbarium, etc. I endeavoured to show him the attentions to which every friend of yours is justly entitled at my hands, and only regret that our time together was so short, for he is a person whom I highly respect. Mr Tolmie had quitted the Columbia

for the North-west coast before I arrived, and thus deprived me of the pleasure of seeing a late student of yours. I wrote to him at once indicating those parts of the country which promise to yield the best harvest to the naturalist, and particularly requesting his attention to the sea-weeds, but have not heard from him since, nor, indeed, at any time. I very much regret not having seen this gentleman, for I should have told him many things useful for a young man entering this country as a botanist or traveller to know. However, I explained them all to Dr Gairdner.

"You will, perhaps, enquire why I did not address you by the despatch of the ship to Europe last year. I reached the sea coast quite broken down, having suffered no ordinary trial, and on my arrival was soon prostrated by fever. My last letter to you was written from the interior of the Columbia, and bore date about the middle of April (1833) last year, just before starting on my northern journey. Therein I mentioned my intention of writing a few lines to you daily, which I did up to the 13th June, a most disastrous date for me, on which I lost what I may call my all! On that morning at the Stony Islands of Fraser's River (the Columbia of M'Kenzie—see the map in his 4to edition) my canoe was dashed to atoms, when I lost every article in my possession saving an astronomical journal, book of rough notes, charts, and barometrical observations with my instruments. My botanical notes are gone, and what gives me most concern my journal of occurrences also, as this is what can never be replaced even by myself. All the articles needful for pursuing my journey were destroyed, so that my voyage for this season was frustrated. I cannot detail to you the labour and anxiety this occasioned me, both in body and mind, to say nothing of the hardship and suffering I endured. Still I reflect with pleasure that no lives were sacrificed. I passed over the cataract and gained the shore in a whirlpool below, not, however, by swimming, for I was rendered helpless, and the waves washed me on the rocks. The collection of plants consisted of about 400 species—250 of these were mosses, and a few of them new. This disastrous occurrence has much broken my strength and spirits. The country over which I passed was all mountainous, but most so towards the Western ocean: still it will ere long be inhabited. I have written to Mr Hay, Under-Secretary of State, respecting the boundary line of the Columbia, as the American Government is anxious to obtain a footing there.

"After this misfortune in June, I endeavoured as far as possible to repair my losses, and set to work again, and I hope some good new species were obtained for the *Flora Boreali-Americana*, which I am very anxious should reach you without delay. It is more than probable that I may have the pleasure of presenting these to you myself, say in March next, as it is my intention to return to England by the very first opportunity; and I hope this small collection may give you some satisfaction, as it is all I can offer you from North-west America. It reconciles me somewhat to the loss, to reflect that you now have friends in that country who will probably make up the deficiency. I have given Dr Gairdner my notes on some more new species of *Pinus*. This gentleman and Mr Tolmie will have a good deal to contend with. Science has few friends among those who visit the coast of North-west America solely with a view to gain. Still with such a person as Mr M'Loughlin on the Columbia they may do a great deal of service to natural history.

"I sailed from the Columbia in November last, in the Hudson Bay Company's vessel, which visited these islands, touching on the way at San Francisco, where I made a short stay, but did nothing in the way of botany. I arrived here on 23rd December, and after spending Christmas Day with two English ladies, the wife of our consul, Mr Charlton, and her sister, I started on the 27th for the island of Hawaii, which I reached on 2nd January 1834. You knew I have long had this tour in contemplation, and having spent three winter months in botanizing here, I proceed to give you a short notice of my proceedings.

"The view of this most interesting island from the sea is sublime indeed, combining the grand, sweet and beautiful in a most remarkable degree. For 2500 feet above the level of the sea, the banana, sugar-cane, coffee, pandanus, bread-fruit, etc., grow in the greatest perfection. Then comes a thickly timbered country as high as 8000 feet, and for 3700 feet more a space covered with short verdure; after which the reign of flora terminates. I made a journey to the summit of Mouna Kaah which occupied fourteen days and found it only 13,851 English feet above the sea; a height, you may observe, much less than has been ascribed to this mountain by early travellers. In this expedition I amassed a most splendid collection of plants, principally ferns and mosses; many, I do assure you, truly beautiful and worthy to range with the gigantic species collected

by Dr Wallich. Of ferns alone I have fully 200 species and half as many mosses, of other plants comparatively few as the season is not yet good for them, nor will be so until after the rains. On my return, I must consult with you on the best mode of publishing the plants of these islands.

"I also visited the summit of Mouna Roa, the Big or Long Mountain, which afforded me inexpressible delight. This mountain, with an elevation of 13,517 feet, is one of the most interesting in the world. I am ignorant whether the learned and venerable Menzies ascended it or no, but I think he must have done so, and natives assert that this was the case. The *red-faced man, who cut off the limbs of men and gathered grass*, is still known here; and the people say that he climbed Mouna Roa. No one, however, has since done so, until I went up a short while ago. The journey took me seventeen days. On the summit of this extraordinary mountain is a volcano, nearly 24 miles in circumference, and at present in terrific activity. You must not confound this with the one situated on the flanks of Mouna Roa, and spoken of by the missionaries and Lord Byron, and which I visited also. It is difficult to attempt describing such an immense place. The spectator is lost in terror and admiration at beholding an enormous sunken pit (for it differs from all our notions of volcanoes, as possessing cone-shaped summits, with terminal openings), 5 miles square of which is a lake of liquid fire, in a state of ebullition, sometimes tranquil, at other times rolling its blazing waves with furious agitation, and casting them upwards in columns from 30 to 170 feet high. In places the hardened lava assumes the form of gothic arches in a colossal building, piled one above another in terrific magnificence, through and among which the fiery fluid forces its way in a current that proceeds $3\frac{1}{4}$ miles per hour, or loses itself in fathomless chasms at the bottom of the cauldron. The volcano is 1272 feet deep, I mean down to the surface of the fire, its chasms and caverns can never be measured. Mouna Roa appears, indeed, more like an elevated tableland than a mountain. It is a high broad dome, formed by an infinitude of layers of volcanic matter, thrown out from the many mouths of its craters. Vegetation does not exist higher than 11,000 feet, there is no soil whatever, and no water. The lava is so porous, that, when the snow melts, it disappears a few feet from the verge, the ground drinking it up like a sponge. On the higher

parts grow some species of *Rubus*, *Fraseria*, *Vaccinium* and some *Junci*.

"I visited also the volcano of Kirauea, the lateral volcano of Mt. Roa; it is nearly 9 miles round, 1157 feet deep, and is likewise in a terrific state of activity. I go immediately to Hawaii to work on these mountains. May God grant me a safe return to England. I cannot but indulge the pleasing hope of being soon able, in person, to thank you for the signal kindness you have ever shown me. And really were it only for the letters you have bestowed on me during my voyage you should have a thousand thanks from me.

"I send this, under cover, to Captain Beaufort, to whom I have written respecting some of my astronomical observations, as also to Captain Sabine.

"I would beg to be affectionately remembered to Dr Scouler and Mr Murray.

"I am, my esteemed Sir,

"Your obedient Servant,

"D. Douglas."

22. The Selecting of Telegraph Poles in the Forest of Enzie.

By T. Sharpe, Manager of Woods, Gordon Castle.

In the January issue of the *Transactions* there appeared a full account of the facilities which the Postmaster-General is prepared to extend to owners of woodlands and forests in the United Kingdom, or to merchants concerned in finding markets for native timber, in order that they may be able to contribute a share of the supply of wooden poles necessary for the requirements of the Post Office.

The essential feature of the Postmaster-General's proposals—the opportunity given to the home-grower or merchant of having the trees he wishes to dispose of as poles examined by a Post Office inspector on the ground, and passed or rejected as the case may be—is a concession much in advance of anything of the same nature that has previously been made, and is probably being widely taken advantage of.

Statistics which may be of some general interest are given on p. 143 regarding the numbers and dimensions of trees felled

in the White-Ash section of the forest of Enzie, on the estate of His Grace the Duke of Richmond and Gordon, and ultimately sold to the Post Office under the new conditions.

The rocks of the region in which the forest of Enzie is situated are mostly of Old Red Sandstone age, but in the area covered by the woods the sandstone is for the most part overspread with a thick mantle of boulder clay or gravelly till. On White-Ash Hill, where the poles were cut, this glacial deposit, although of considerable depth, is thin in texture. Judging from the appearance of the surface vegetation, consisting largely of heather, the soil and subsoil are not capable of supporting a large crop of trees, and are only suitable for being planted with the least exacting species.

The existing wood consists exclusively of Scots pine. Its age ranges from 75-80 years, and as the trees which were converted into poles were on the whole, as regards size, only slightly under the dimensions of the remainder of the crop, it will be seen that the rate of growth has been slow. The wood has, however, always been grown fairly close. No excessive thinnings have been made at any period in its life-time, with the result that clean stems well suited for being used as telegraph poles have been produced.

As this was noted, and as it was also thought that an opportunity was afforded under the new scheme for profitably disposing of the thinnings which it was deemed necessary to make in order that the final crop might increase considerably in diameter before being felled, it was decided to mark a number of trees for sale. They were purchased by Messrs Jones, timber merchants, Larbert, who after the felling operations were completed arranged for an examination to be made of the poles before they were barked or dispatched to the creosoting yards.

Under the supervision of Mr Roberts, inspector of telegraph poles, who had been sent for the purpose of examining the felled trees set aside for poles, the tops were sawn off at the point where the minimum diameter specified for was reached. The poles were then classified according to their length, the diameter at 5 feet from the butt end, and at the top.

Poles classified stout were stamped with three crowns on the butt end, medium with two, and light with one. Each pole was also stamped with the initials of the inspector, and with a mark

indicating the depot to which they were to be consigned. The rejected tops can be utilised as pit props.

In addition to the above measurements, which were all that were required for the official classification, the girth at the centre of the pole was also measured in the case of what seemed average examples, and the cubical contents estimated in order that a comparison might be made of the measurements with those given for Scandinavian red fir poles in the January issue of the *Transactions*.

The accompanying table shows these measurements:—

No. of Poles	Length	Quarter-Girth (under bark) at Centre of Pole	Cubic Contents per Pole
		Light	
2	20 Feet	5¼ Inches	3·67 Cub. feet
1	22 ,,	6 ,,	5·50 ,,
2	24 ,,	5 ,,	4·16 ,,
3	26 ,,	5½ ,,	5·47 ,,
12	28 ,,	6 ,,	7·00 ,,
		Medium	
38	26 Feet	7¼ Inches	9·48 Cub. feet
62	28 ,,	6½ ,,	8·20 ,,
64	30 ,,	6½ ,,	8·78 ,,
45	32 ,,	7 ,,	10·88 ,,
57	34 ,,	7 ,,	11·57 ,,
92	36 ,,	7½ ,,	14·06 ,,
42	40 ,,	7¼ ,,	14·60 ,,
13	45 ,,	7¼ ,,	16·32 ,,
2	50 ,,	8¾ ,,	26·50 ,,
		Stout	
102	32 Feet	7¾ Inches	13·34 Cub. feet
97	34 ,,	8 ,,	15·10 ,,
148	36 ,,	8½ ,,	18·00 ,,
183	40 ,,	8½ ,,	20·06 ,,
90	45 ,,	9¼ ,,	26·77 ,,
28	50 ,,	10½ ,,	38·27 ,,
1	55 ,,	10½ ,,	42·10 ,,

It will be seen from a study of these data that the dimensions of the poles agree fairly closely with those given for Scandinavian poles in the tables referred to above.

The figures are therefore of some value in demonstrating

that it is possible to grow in home woods, even when the quality of the soil is below that of the average type of plantable moorland, poles as suitable for the requirements of the Post Office as those which are produced in the forests of Scandinavia and Russia; and there is no reason, if the State showed the same zeal in encouraging and assisting afforestation as it has done in helping us to find markets, why the country should not become largely independent of these sources of supply.

23. A Braconid Parasite on the Pine Weevil, *Hylobius abietis*.[1]

By J. W. Munro, B.Sc.(Agr.), B.Sc.(Arb.), Edin.

The following notes are the result of observations made on pine weevils and parasites collected in a plantation on the estate of Banchory-Devenick near Aberdeen. The plantation in question was formed in the spring of 1911, a year after the removal of the old crop, which was a pure wood of Scots pine. The stumps and roots of this old wood afford ideal breeding places for the pine beetle (*H. piniperda*) and the pine weevil (*Hylobius abietis*), and they are to be found in considerable numbers.

The work of the pine weevil is familiar to all interested in forestry. It is harmful only in the adult state and does considerable damage by gnawing the tender bark of young conifers, causing them to wilt and die. Where conifers are not to be got it will readily attack birch, mountain ash and oak.

In the larval stage *Hylobius* is harmless. The adult deposits her eggs in or under the bark of the stumps of various conifers but prefers Scots pine. The larva on hatching out commences to tunnel between the bark and the sapwood, and when full grown pupates at the end of this tunnel, either in a cavity or hook gallery in the sapwood, or in a cavity in the bark. The tunnels are filled with frass, consisting of tiny chips of wood bitten out by the larva and passed through its body.

The whole of the larval life is passed in such a tunnel. In the spring of 1912 I noticed a few tiny cocoons lying in one of these tunnels, but I attached no importance to them at the time. In July of last year, however, I found several weevil larvæ

[1] Reprinted from the *Annals of Applied Biology*, vol. i., No. 2, July 1914.

apparently in the resting stage, which were attacked by a small legless maggot feeding on them externally. I collected a number of weevil larvæ both attacked and immune, and also a number of the attacking maggot. In some cases the weevil larvæ were sucked quite flat, and in a few days all those which had been attacked were in this condition. Accordingly I supplied the parasitic larva with more grubs and found that they fed on them readily, crawling 2 or 3 inches to reach their new prey.

These parasitic larvæ measured somewhat over a quarter of an inch in length, and were covered with very short reddish-brown hairs. Unfortunately I was unable, through lack of proper instruments to make a close examination of them, and I could not make out the mouth parts. Observation showed, however, that they fed through the skin of their host and were purely external parasites. In September the parasites ceased feeding, and a few days after they moulted and became more definite in shape, and I assumed then that they were Hymenopterous. A fortnight later, on 25th September, they commenced spinning silky cocoons, and in a few hours they were completely hidden. All through the winter I examined a few of these cocoons every week, but no alteration in the external appearance of the enclosed larvæ was visible until 20th February, when in two out of five cocoons I found pupæ. Nine days later the first imago emerged, which I recognised as a Braconid of some sort.

Dr MacDougall informs me that three years ago he obtained a Braconid parasite on *Hylobius*, but in such a battered condition as to be unrecognisable. So far as I have been able to ascertain, I know of no other British record of a Braconid on *Hylobius*. In Ratzeburg's *Ichneumonen der Forstinsekten*, however, there is a short account of the rearing, by Nordlinger, of 40 ♀♀ and 4 ♂♂ from the larvæ of *H. abietis*. I may be permitted to quote Ratzeburg's account. "Nordlinger bred 40 ♀♀ and 4 ♂♂ from this species (*Hylobius abietis*) each of whose larvæ supports about ten parasites. The cocoons of the latter are firm, oat-shaped and papyraceous, woven among their hosts' frass and dead bodies, and often constructed at the end of the beetles' tunnels beneath fir bark." This description agrees in every respect with my own observations, and accordingly I looked up Ratzeburg's description of the species which he calls *Bracon hylobii*. It again agrees with the insects I have bred out, and as I have been unable to identify my specimens with any of the

Bracons in the South Kensington collection, or with those described by Marshall, I think it highly probable that the species I have reared is *B. hylobii*. If so it is a species new to Britain, and in order to be sure of this I have sent specimens for identification to Dr Szepligeti in Budapest.

The degree of parasitism by *B. hylobii* on the pine weevil may be of interest. In winter 1911 I observed no cocoons. In the spring of 1912, two years after the old crop was removed and presumably in the second year of the beetles' occurrence there, I observed a few cocoons, while in 1913 and 1914 every third pupating chamber was occupied by them. This represents parasitism in the third and fourth years of the pest of over 30 per cent.

I think I do not exaggerate when I suggest that *Bracon hylobii*, Ratz., may prove of considerable value in combating the pine weevil, which is every year becoming more and more common in newly-formed plantations, especially in Scotland. The parasite is, in all probability, fairly common where *Hylobius* is found. The fact that it has hitherto apparently been unrecorded does not imply that it is scarce. The persons most interested in *Hylobius*, the forester and the factor, are interested only in the adult beetle when it begins its attacks on their plantations, and any measures they may take against it are as a rule confined to the trapping and collecting of the adult.

As to the possibility of using *B. hylobii* in combating *H. abietis*, I have not yet obtained a sufficient knowledge of the former's life-history to make any definite statement, but such observations as I have been able to make lead me to believe there are no special difficulties to overcome. If *B. hylobii* is fairly or reasonably common, and there is no reason to suppose it otherwise, there should be little difficulty in obtaining batches of its cocoons, or numbers of its larvæ to breed from. The larvæ of *Hylobius*, too, can readily be kept alive if they are not removed from the roots on which they are feeding. I have reared several weevils by removing the smaller roots containing their larvæ and keeping these sufficiently moist. The parasite itself is easily reared, inasmuch as I bred one batch in an ordinary collecting tube in which I placed a weevil grub as food.

Out of about 70 cocoons, I have obtained no hyperparasites on the Braconid. This again is favourable. The parasite too is evidently hardy. The plantation from which my specimens

Fig. 5. Light Railway Leading to Upper Terminal of Aerial Ropeway at Farley.
(See p. 131).

[*To face p.* 146.

FIG. 1. LARIX OLGENSIS.

1, Cone; 2, outer side of scale; 3, inner side of scale; 4, bract; 5, seeds; 6, current year's twig; 7, second year's twig (all life-size).

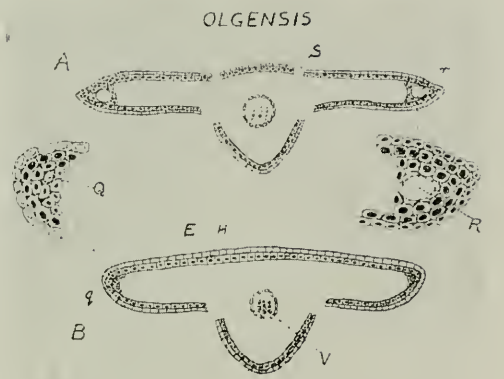


FIG. 2. LARIX OLGENSIS.

A, Cross-section of leaf of long shoot: B, cross-section of leaf of short shoot; R, *r*, resin-canal well developed in the former; Q, *q*, obsolete resin-canal in the latter; S, stomatic opening; E, epidermis; H, hypoderm; V, fibro-vascular bundle (all highly magnified).

were obtained is a bleak hillside near the coast and over 300 feet above sea-level. It is often swept by cold north and east winds.

Another interesting fact is that *B. hylobii* attacks the weevil larva in its resting stage, at a time when the latter is practically inactive.

Since the above paper was written I have been enabled to renew my investigations and experiments on *Bracon hylobii*. Both laboratory and field experiments are now in progress, and until these are completed and their results ready for publication it would be inadvisable to make any further statements. I may say, however, that so far as observations go they confirm those given above. *B. hylobii* has now been found in several widely separated areas.

Much still remains to be done before the relations of *Bracon hylobii* and the weevil are fully understood, and especially before the practical value of this parasite as a check on *Hylobius* on a large scale can be fully demonstrated.

24. A New Species of Larch.

(*With Plate.*)

The following description of a new species of larch, by Prof. Augustine Henry, is taken from the *Gardeners' Chronicle*, 27th February 1915, p. 109:—

In the Kew herbarium there are two or three twigs with leaves and cones of a peculiar larch, gathered in 1860 by Maximowicz on the shores of Olga Bay, about 120 miles north-east of Vladivostock, in the maritime province of Eastern Siberia. This larch was labelled *Larix sibirica* by Maximowicz; but is remarkably distinct, having different branchlets, leaves and cones, and, moreover, it occupies an isolated district far removed from the region inhabited by the well-known Siberian larch. It is readily distinguishable from all the species hitherto published, and will now be described (Plate XIV. Fig. 1) as a new species, *Larix olgensis*.[1]

[1] *Larix olgensis*, A. Henry, sp. nova. *Larix sibirica*, Maximowicz, ex M.S. inherbario (non Ledebour); Masters, in *Journ. Linn. Soc.* (*Bot.*), xviii., 523 (ex parte); Komarov, *F. Manshuriae*, i., 194 (1901); Patschke, in Engler, *Bot. Jahrb.*, xlviii., 602 (1913).

A tree, of which little is known concerning habit or dimensions, unique amongst the genus in having reddish-brown, slender young branchlets, densely covered with long hairs, traces of which remain on the greyish, older twigs; lateral buds shining dark brown. Short shoots, slender, conic, with similar buds, fringed around the base when opening with reddish-brown hairs.

Leaves, short and slender, not exceeding $\frac{3}{4}$ inch long and 0·025 inch wide, curved, rounded at the apex, convex above, deeply keeled beneath, with one stomatic line on each side of the keel. Microscopic section [1] (Fig. 2) shows a fibro-vascular bundle, circular, with scattered wood cells; hypoderm of thick-walled cells, continuous under the epiderm all round. Resin-canals present in leaves of the long shoots, large, placed more inwards than usual in the genus, being separated from the epidermis by two layers of thick-walled hypoderm. Leaves of the short shoots, with rudimentary or obsolete resin-canals, differing also from the leaves of the long shoots in being slightly deeper in proportion to their width and without stomatic lines above. Cones 0·6–0·8 inch long, 0·5–0·6 inch wide when closed, with the exserted tips of the bracts visible between the scales, which are 20 to 30 in number, in 4 to 6 rows, 0·3 inch wide and slightly less long, reniform-orbicular, entire and rounded at the upper margin, covered externally with a dense minute pubescence. Bract 0·2 inch long, oblong, but widest at the base, truncate at the apex with a minute mucro. Seed with wing $\frac{1}{4}$ inch long; body 0·1 inch long, marbled grey on the surface next the scale, shining dark brown on the other surface; wing short, brown, broadest towards the base.

The description of this larch is mainly drawn up from a few twigs with cones, which were sent home by Captain Clinton-Baker, R.N., in 1911, with the note: "The only conifer at Olga and Vladimir Bays, all nearly cut down for timber." It is possible that this larch extends farther inland and to the northward; but Komarov,[2] who confused it with *L. sibirica*, states that

[1] The microscopic details, diagram and photograph, are due to Mr M. O'Beirne, research scholar in Forestry at the Roy. Coll. Science, Dublin. The blocks have been kindly lent by the editor of the *Gardeners' Chronicle*.

[2] Dr Komarov, of the Petrograd Imperial Botanic Garden, in a recent letter to Prof. Henry, states that this larch only occurs in two forests of small extent, one on the coast of Olga Bay, the other a little south of this in the valley of the river Pihusun. In Kamtschatka, and elsewhere on the mainland of eastern Siberia, *Larix dahurica* is the species of larch met with.

it is only found on the shores of Olga Bay, and quotes a letter written by Maximowicz. "Common on the east coast of the great bay, forming an open wood on rocky ground in mixture with *Quercus mongolica* and *Betula Ermani*. Trees often occur up to a foot in diameter, with very brittle, wide-spreading gnarled branches."

The district where this larch occurs is on the continental coast immediately opposite Yezo. It is characterised by a severe climate, the average annual temperature being only 40° F. with an average summer temperature of 68° F., while the sea, though not actually frozen over in the winter, is often coated with ice near the shore. Reclus, *Nouv. Geog. Univ.* vi., 835 (1881), states that the temperature at Olga rises in August sometimes to 96° F. The climate appears to be an extreme one; and in all probability this larch would be of no economic value in this country; but seeds ought to be obtained, as it possibly might thrive high up in the mountains.

25. The "Hybrid Larch."

(*With Plate.*)

By J. M. Murray, B.Sc.

The name "hybrid larch" is usually applied to plants raised from seed of Japanese larch, *Larix leptolepis*, collected in this country.

Many foresters have doubts as to the hybridity of the plants, and it is impossible to say as yet how far these doubts are justified. The chief arguments for and against hybridity will be given, but at the same time it is not intended to introduce any bias towards either side; the question should at present remain an open one.

It is often assumed that a first cross should show characters which are intermediate between those of the parents. The earliest recorded crosses made by a botanist were of this nature (Kölreuter, 1761), and horticulturists to the present day usually start operations on the hypothesis that their hybrids will show intermediate characters. This, however, is only one of many possibilities.

Recent work has shown that in hybrids between members of closely-related races intermediate characters are often wanting,

and the plants resemble one or other of the parents. It is then customary to speak of *dominant* and *recessive* characters. The former is the character which determines the appearance of the hybrid; the latter lies suppressed and apparently lost.

A further complication not infrequently arises when in certain hybrids it cannot be determined which character is recessive and which is dominant. The results may vary in each individual case where the characters are brought into conjunction.

On occasion also, an *apparently* new character may be introduced. Weismann, in *The Germplasm* (1892), has explained that this character is not new but had been present in a latent condition in one of the parents.

A much more frequent variation of the hybrid from the parent lies in the rate of growth. This may be slower or faster. With nearly-related parents it is usually faster, but no generalisation can be made. As an instance of this, Buddleia hybrids have been known to grow as big in three years as the parents would grow in five or six. These examples do not, by any means, exhaust the recorded variations in hybrids, but they will serve to broaden our views on the possibilities.

We may now proceed to examine the case for and against hybridity in the larch. In the first place, it is found that most of the plants show somewhat intermediate characters in their shoots. These lack the red colour which is so characteristic of Japanese larch and approach nearer to the colour that is found in the European species.

It must be observed, however, that all the plants raised from seed collected off one tree do not always show this blended character. It is often possible to divide the plants into three groups, viz.—(1) Those that show distinct *L. leptolepis* characters; (2) those in which there are intermediate characters; (3) those in which there is an approach to *L. europæa*. The presence of pure Japanese larch plants need not be associated with any dominance of characters. The plants, if hybrids, are natural ones, and there is always a chance of no specific cross taking place.

The appearance of an approach to European larch is not so easily explained. It cannot be said that there is any difference in the leaves and cones of the known parent and offspring. Both are of the normal *L. leptolepis* type. The rapidity of growth will be referred to in detail later on, here it is sufficient

to say that, so far as yet observed, the "hybrid" is much more rapid than *L. leptolepis* or *L. europæa* in the same locality. In the seedling state the "hybrids" are, like *L. europæa*, semi-evergreen.

From this evidence it will, I think, be admitted that there is a fairly strong case for hybridity.

It is said that plants raised from seeds got in pure Japanese larch plantations show little or no difference from the parents. If this be so it is another strong argument in favour of hybridity in the case of the progeny of isolated trees, since it was from such that the first and best-known "hybrids" showing variation were raised.

Those who doubt hybridity base their case mainly on the difference in the times of flowering of Japanese and European larch. I have observed that the former produces its male and female flowers at from ten to fourteen days before the latter. It is not uncommon to find that some of the earliest Japanese larch female flowers are just beginning to close when the male flowers of the European species are just mature. On the other hand there are trees which, either on account of environmental factors, or on account of some inherent quality, come into flower much later than the mass of their fellows. So far, it has not been observed that the seeds from these produce plants which differ in any way from the offspring of the earlier flowering trees.

Moreover, among conifers, hybrids are notoriously rare. The best-known examples are Vilmorin's cross between *Abies Pinsapo* and *A. cephalonica*, and the supposed natural cross between *Pseudotsuga Douglasii* and *Abies pectinata*, which is said to have given rise to *P. Douglasii* var. *Standishii*.

It has been suggested that the "hybrid larch" is merely a variation resulting from climatic influences. It is a well-known fact that plants may undergo a more or less marked change of habit when transferred to a new soil or climate. These modifications appear in succeeding generations, probably owing to re-impression. Alongside this there is yet the other possibility that a radical change of environment may produce variations in succeeding generations. These variations have been found to breed true. It must be left to those who have studied the Japanese larch in its native habitat and in this country to say what changes they have observed.

Setting aside this rather uncertain question of parentage, we may come to matters of perhaps greater interest to the forester, namely, the rate of growth and liability to become injured by fungi, insects or frost. One of the oldest groups of "hybrid larch" that I know is on the Murthly estates.[1] The site selected for this group was not by any means an ideal one for larch, being rather low. In fact, the place is an ideal one for the spread of disease. The soil is poor and gravelly, but on the whole not unsuited to conifers. In the spring of 1908 about three hundred 3-year old plants twice transplanted were planted in this place at an average distance apart of about 4 feet. Growth immediately after planting was only moderately fast, but it has been making up every year since then. Unfortunately no measurements were kept, so that now, in order to find out something of the rate of growth, it has been necessary to have recourse to the method of "stem analysis." The method of making a stem analysis is quite simple and would provide much matter of interest to the forester who can find time to make it. A stem was selected for analysis, and in this case it was considered that for all ordinary purposes measurement in four-foot lengths would be sufficient. These four-foot lengths were then marked on the stem as shown in Fig. 1 (by dotted lines).

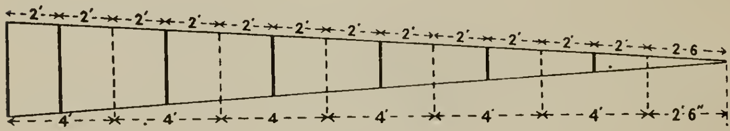


FIG. 1.

Each of these divisions was again divided into two (marked in the diagram by heavy line), and a section was taken at each of these new divisions. These sections were taken to be the mean of the four-foot divisions to which they referred.

In order to check the results and also to give a rather more representative diagram, sections were made at the four-foot divisions also, but this is not usually necessary.

The number of year-rings in each section was then counted, and the diameters at the several ages measured. The measure-

[1] It is possible that plants about two years older exist on Dunkeld estate.

ments were then plotted so that a representation of a longitudinal section through the tree was obtained (Fig. 2). From this

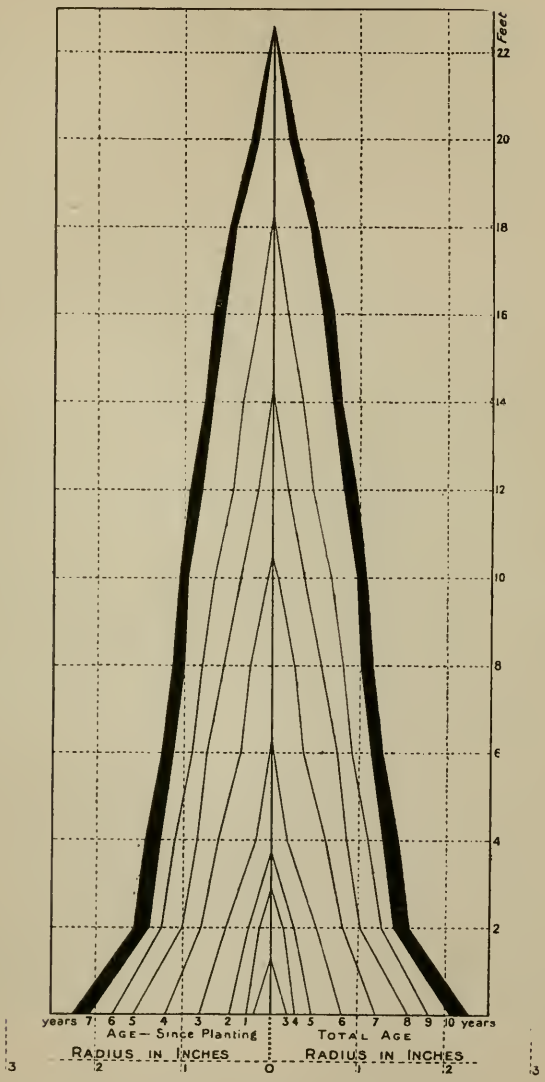


FIG. 2. A VERTICAL SECTION OF THE TREE.
The thick black line represents the bark.

picture the increment at any period in the life of the tree can be calculated. Since only the present thickness of the bark is

obtainable, these investigations only refer to increment in wood.

To facilitate comparisons the following results have been tabulated:—

Height-Increment.

Age		Total Height		Annual Increment	
Since Planting	Since Sowing				
Years	Years	Feet	Inches	Feet	Inches
...	0	...	...	...	...
...	1	0	4	0	4
...	2	0	9½	0	5½
...	3	1	2½	0	5
1	4	2	9½	1	7
2	5	3	7	0	10½
3	6	6	3	2	8
4	7	10	4	4	1
5	8	14	3	3	11
6	9	18	3	4	0
7	10	22	6	4	3

The mean annual height-increment for the ten years' period has been 2 ft. 3 ins.

No explanation can be offered for the very erratic growth between the third and fifth years. It may have been due to atmospheric or soil factors, but leaving this out of account it is seen that the annual height-increment has been exceptionally good.

Although it is rather unfair to compare these figures with those for true *Larix leptolepis* grown in another part of the country, still something may be gained by doing so. Probably the figures so obtained will be more valuable if it is stated that Japanese larch on Murthly estates does not compare favourably as regards measurements with those that are given. From Mr Leven's report in vol. xxviii., part 2, it is seen that at seven years from planting the highest tree recorded is 15 feet, or exactly 7 ft. 6 ins. smaller than that of this average "hybrid" tree.

The increase in diameter can also be traced out, and it is given on the following page.

Here again some irregularity is to be noted in the increment. This is not uncommon near the base of young stems, however. The drop last year is probably due to increased density of canopy. The girth may be compared with that of the Japanese larch quoted above. It is then found that there is a difference

HYBRID LARCH GROUP. SUMMER 1912.

[*To face p.* 154.

FIG. 1. DOUGLAS FIR PLANTATION AT STANLEY, NEAR PERTH, ABOUT 55 YEARS OLD.

FIG. 2. THUYA PLICATA PLANTATION AT BENMORE, ON THE CLYDE, 30 YEARS OLD.

of about an inch in favour of the "hybrid larch." A volume analysis might also be prepared, but as yet it is not considered advisable to do so. At the same time the height and diameter increment indicate a good volume increment.

Diameter at 4 ft. 3 ins. above Ground.

Age		Diameter	Annual Increment
Since Planting	Since Sowing		
Years	Years	Inches	Inches
1	4	...	...
2	5	...	...
3	6	·3	·3
4	7	1·2	·9
5	8	1·7	·5
6	9	2·2	·5
7	10	2·5	·3

As will be seen from Plate XV. this group is of very robust growth. It is exceptionally healthy, comparatively free from chermes attack, and absolutely free from canker. It is true fructifications of Dasyscypha have been found on the stems, but, probably owing to the rapid growth of the trees affected, no cankers were formed. At the same time absolute immunity from disease is not claimed for this plant, since elsewhere several plants have already been destroyed through this cause. On the whole, however, so far as I have seen, the "hybrid" is much less attacked by chermes, or by fungoid disease, than any European or Japanese larches growing alongside it. It also shows straighter stems, and less tendency to branch at the crowns than does the Japanese larch. As regards frost it seems to be as hardy as the European species.

It will be well not to be over-sanguine in our hopes of the "hybrid larch." It may, like its known parent, the Japanese larch, grow well only in certain localities—that is, it may be a "locality tree." If so we must be prepared to hear of many shattered expectations regarding its growth.

Further, it is impossible to say how long the present recorded rate of growth will be kept up. Extremely rapid growth in early youth is not always a good quality in forest trees, since it frequently leads to an early maturity and culmination of growth. Of this there are many examples, one of which, referring to the growth of *Larix leptolepis* in the Japanese castanetum, is cited in

Professor Henry's article in vol. xxix., part 1. Time only can settle this question for the "hybrid larch."

In conclusion, I may mention that cross fertilisation experiments in larch were commenced at Murthly last year. In these the crossing was done both ways, viz., *L. europæa* ♀ × *L. leptolepis* ♂, and *L. leptolepis* ♀ × *L. europæa* ♂. The resulting seeds have been sown recently, but so far only some half-dozen plants have been got. These are all from the *L. europæa* ♀ and *L. leptolepis* ♂ cross. It is hoped that some of the others will yet germinate.

I might suggest here that these experiments might be tried elsewhere, and further that branches bearing male and female Japanese larch flowers be also enclosed in bags so that pollination is only possible with pollen of the same species. In this way it may be possible to arrive at some definite conclusion as to the nature of the plants.

26. North American Forest Trees in Britain.[1]

(*With Plates.*)

By Prof. A. Henry.

Many North American species of trees are cultivated in this country, but most of them are only of ornamental or botanic interest. Those which are of value as producers of timber are few in number, but of immense importance, and it is to this class that I shall confine my remarks.

Exotic trees are absolutely necessary for the economic production of timber in the British Isles. This is admitted in practice, and is sound in theory. Our native species are few in number, all being late immigrants from the continent of Europe after the glacial epoch, and are by no means those that are most suitable to the climate conditions of the present day, or that are most fit for producing, as quickly as possible, valuable timber.

The Scots pine, our solitary forestry conifer,[2] was widely

[1] Reprinted from the *Gardeners' Chronicle*, March 1915. We are indebted to the editor for the loan of the accompanying blocks.

[2] Our other indigenous conifers, the yew and juniper, are not used in modern planting. The spruce is not a native of the present epoch; but cones of *Picea obovata* have been found in preglacial beds at Cromer, Mundesley, Bacton, and Happisburg in Norfolk, and near Cappard in Galway. *Picea obovata* is the species now existing in Northern Scandinavia, Finland, Northern Russia and Siberia.

spread over the British Isles in the dry, warm continental climate that prevailed at the beginning of the neolithic period; but it has, with the advent of our present humid, cool climate, gradually disappeared from all parts of the islands, except in the great mountain *massif* of the Scottish Highlands. It is at the present time distinctly a tree for use in certain districts only, characterised by a low annual rainfall and much sun in late summer and autumn, as in Speyside and Deeside in the north, and in the sandy heaths of the south and east of England. In such districts it regenerates freely, and attains a great height, producing a satisfactory volume of timber of good quality.

Our own foresters in their early introduction of the spruce, larch, silver fir and sycamore from the continent of Europe were distinctly improving on nature. All these trees were largely used in plantations in the eighteenth century. The movement towards extensive use of exotic trees was accelerated by the discovery in the early part of the nineteenth century of the trees of the Pacific Coast region of North America, where, in a climate absolutely similar to our own, the highest and most valuable type of coniferous forest on the planet has been evolved.

The North American forests deserve careful study, as they comprise three great regions,[1] which are absolutely distinct in climatic conditions. These are :—

I.—Eastern region, which is the largest, and extends from the edge of the Rocky Mountains region eastwards to the Atlantic.

II.—Rocky Mountains region, which comprises that great mountain range, with its ramifications and foothills down to the plains on either side, and includes roughly the Yukon, eastern part of British Columbia, Alberta, Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico.

III.—Pacific Coast region, which extends from the western boundary of the last region to the coast, and includes Alaska, the western part of British Columbia, Washington, Oregon and California.

[1] See map given by Sargent as frontispiece of *Manual of the Trees of North America* (1905). I have omitted, as unimportant, three small districts on this map, one in the extreme south of Florida, where the vegetation is tropical, and two narrow bands lying along the Mexican boundary, where the trees are similar to those of Mexico. The Eastern division and the Pacific Coast region are each subdivided by Sargent into a northerly and a southern area.

The climate of both the Eastern region and the Rocky Mountains region is an extreme one, a so-called continental climate, distinguished by great cold in winter, an abrupt change from winter to spring, with an absence of spring frosts, followed by a sunny, warm summer and autumn. The climate of the Pacific Coast region and that of the British Isles and the western border of Europe generally may be called insular, or maritime, being characterised by the absence of great cold in winter, an erratic transition from winter to spring, with great liability to spring frosts, and no great heat in summer, while dull, cloudy days and fogs occur at all times of the year. The trees which live in a continental climate are rarely adapted to thrive in an insular climate. The great distinction between the regions of North America is well shown at the Arnold Arboretum,[1] near Boston (U.S.A.), where the Douglas fir, *Abies grandis* and *Thuya plicata* from the shores of the Puget Sound refuse to grow, while individuals of all these species from Idaho and Colorado make thriving specimens.

The trees in the Pacific Coast region are remarkable for their great height and vigour of growth, resulting in an amazing volume of timber per acre, and constituting a unique type of forest. No complete explanation of this phenomenon has been offered, but it is evident that the trees along the coast are not checked in growth by any xerophytic conditions. The evaporation from their foliage is small, being hindered by the humid atmosphere which surrounds them. The heavy rainfall and the splendid condition of the soil, which is usually deep, nearly always heavily shaded, and invariably covered with the humus of a thousand years, provide an immense supply of moisture. Possibly the dull, cloudy light which prevails is an optimum one for the chlorophyll function. The combination of all these factors enables timber to be built up at an extraordinary rate by the trees in this region.

It is fortunate for us that when introduced into our congenial climate, these wonderful trees preserve their vigour. It may be noted that the Pacific Coast region has a climate singularly like that of the extreme west of Europe, Alaska corresponding roughly to Norway, British Columbia to Scotland, Washington to Ireland, Oregon to Western France, and California to Portugal. These climatic subdivisions are important in regard

[1] Cf. *Arnold Arboretum Bulletin Pop. Inf.*, No. 60 (1914).

to the selection of proper seed-collecting stations. Some species, such as the Douglas fir and the Sitka spruce, are distributed over an immense area, and on that account require special study. It is well known how superior in vigour is the Douglas fir growing close to the coast to the same species growing in the mountains far inland. Furthermore, individuals of northern stations are not so vigorous as those of southern stations. All such differences are doubtless inheritable; and this is of importance in regard to the following point. Very little is known of wind force on the Pacific Coast; but it is believed that trees of immense size occur in localities where the winds are as constant and as strong as in Ireland, and if this is the case seeds of such trees would be specially valuable. Special forms of Sitka spruce for our mountain plantations could no doubt be found superior to any yet introduced. There are at least two types of *Thuya plicata* now growing in England, one characterised by much greater vigour than the other; and as this important tree is widely distributed, seeds from the most suitable locality should alone be employed.

We should establish at once, with the aid of the Governments of British Columbia and Washington State, seed-collecting stations under the supervision of a trained forester. The localities where vigour and good form of the different trees exist with considerable exposure to wind, would serve as collecting grounds for the seed to be used in raising plants for similar stations in Ireland, and also Scotland and Wales.

The value of the conifers of the Pacific Coast region is now universally admitted, not only in this country, but also in Belgium and Germany. Three species—Douglas fir (Plate XVI. Fig. 1), Sitka spruce and *Thuya plicata* (Fig. 2)—are being planted more and more every year throughout these islands, not only by private owners, but also by public bodies like the Department of Agriculture in the State forests of Ireland, the Commissioners of Woods at Inverliever in Scotland, and various municipal corporations in their water-catchment areas. These three species provide, under suitable conditions of soil, climate and shelter, vast quantities of timber at an early age. Rotations of forty years are possible; and in afforestation on a large scale, a necessary work in this country in coming years, we must mainly rely on the Pacific conifers and on the European larch for obtaining quick and remunerative returns. As an instance,

I may cite the figures of a plantation of Douglas fir and *Thuya plicata* at Gairletter, near Dunoon, on the Clyde. This yielded, thirty-five years after the date of planting, 7430 cubic feet (quarter-girth measurement) of timber per acre, or more than 200 cubic feet per annum. The timber was sold in Glasgow for scaffold poles and other similar uses, the net proceeds being £130 per acre. Allowing for the expenses of planting, taxes, maintenance, and all the other charges actually incurred, and reckoning compound interest at 3 per cent., this plantation yielded £2 per acre per annum net revenue.[1] The land, while well situated near a market, was rough and rocky and of no value for tillage.

Of the other conifers of the Pacific Coast region, the most important are Lawson cypress, Nutka cypress, *Cupressus macrocarpa*, and *Pinus insignis* (*P. radiata*). *Pinus insignis*, if planted in suitable localities near the sea, in the western parts of England, Wales and Ireland, would produce a large volume of coarse timber in a short term of years. It will, however, probably prove more useful for shelter-belts near the sea. It has been planted with great success for the purpose by Mr Dorrien Smith on Tresco, one of the Scilly Isles, where the violence and constancy of the wind are extreme.

The Lawson cypress, a native of south-western Oregon, is remarkable for its freedom from injury by frost, insects or fungi; moreover, it bears wind well. It is very cheaply raised from seed, and is easily transplanted. It is not, however, so fast in growth as the species mentioned above, and there are no records of its volume as a forest tree in dense plantations. It would certainly yield valuable timber if planted closely at the start. It thrives on peat at Abbeyleix and other places in Ireland, and might prove admirable for planting in bogs either pure or introduced by groups into areas which have already been covered by seedlings of maritime pine.

The Nutka cypress, coming from a more northern region, Alaska and British Columbia, is still slower in growth; but possibly more vigorous trees might be raised by getting seeds from its most southerly stations in Vancouver Island, and these would be invaluable for shelter in wind-swept regions in the north of Ireland. This tree might also be propagated by cuttings for hedges around gardens in exposed parts of Donegal, Mayo, etc.

[1] See *Trans. Roy. Scot. Arbor. Soc.*, xxviii. p. 175 (1914).

FIG. 3. CUPRESSUS MACROCARPA, 19 YEARS PLANTED, IN PHŒNIX PARK, DUBLIN.

[*To face p.* 160.

FIG. 4. ABIES NOBILIS PLANTATION AT DURRIS, WITH A FEW OAK STANDARDS OVERHEAD; JAPANESE LARCH IN THE BACKGROUND.

Cupressus macrocarpa, though it has scarcely been tried as a forest tree, appears to be one of the most desirable species in the milder parts of the British Isles, where it will produce with extreme rapidity a large volume of valuable timber in situations at no great elevation above sea-level. The wood is very durable, being heavier than that of other cypresses, and possessing only a faint odour. This tree grows naturally in a restricted area at Monterey in California, between the sea-beach and the inland belt of *Pinus insignis*, in a climate characterised by absence of frost, frequent cloudy days, and an atmosphere kept humid by the strong winds off the ocean. It is much hardier than its natural habit would lead one to suppose, and has been planted with success in many parts of the world as a wind-screen and hedge plant. It grows readily from cuttings; but seedlings are preferable. From 1 lb. of seed costing a few shillings, 20,000 to 30,000 plants may be raised which are ready for planting out at a year old, when they average 8-10 inches in height. The tree appears to grow rapidly on most soils, succeeding even on hot shallow chalk downs in Sussex. Planted close it forms clean stems free from branches to a considerable height, as may be seen in a mixed plantation at Enys, in Cornwall. A grove in the Phœnix Park, 19 years planted, has trees ranging from 40 to 55 feet in height (Plate XVII. Fig. 3).

Another valuable tree of the Pacific Coast region is *Tsuga Albertiana*, which produces natural seedlings in many places where it has been introduced. It appears to be a very vigorous and healthy species, which can be used for under-planting and in mixture with larch and other valuable timber trees, as a fast-growing soil-improver.

Pinus ponderosa has never been tried as a forest tree in this country. Individual specimens in the southern half of England, as at Arley Castle and Bayfordbury, have grown about as fast and as tall as Corsican pine, attaining about 100 feet in height and 8 to 10 feet in girth, in 70 or 80 years. If tried, the seed might be obtained from stations in Washington, west of the Cascade Mountains.

Pinus muricata grows in northern California in situations described as "water-soaked sandy plains, covered with heath plants." It might be tried on peat bogs, though their afforestation had better not be attempted at present, seeing that a large

quantity of land much better suited for planting is available in most districts.

The two species of *Sequoia* grow extremely fast in suitable situations in these islands, but the quality of the timber produced does not justify their employment on an extensive scale.

Of the silver firs of the Pacific Coast region, *Abies grandis* is decidedly the most promising, surpassing even the Douglas fir in rapidity of growth. At Avondale, it is less subject to spring frosts than the common European species. Mr Crozier states that at Durris, in Kincardineshire, it has been free from all trace of disease (chermes, etc.), producing a great volume of soft, white timber available for box-making. It may be useful in situations unsuitable for Douglas fir or larch. *Abies nobilis* also grows at Durris (Plate XVIII. Fig. 4), where it succeeds well.

The broad-leaf trees of the Pacific Coast region are few in number, and comparatively unimportant for forestry purposes. The most interesting species are *Populus trichocarpa*, *Fraxinus oregona*, *Betula Lyalliana*, and *Umbellularia californica*. The first-named is liable in botanic gardens to canker, but in some places has thriven amazingly. The Oregon ash may be useful. *Betula Lyalliana* (commonly known erroneously as *B. occidentalis*) is the best of all the birches, and from the seed which I gathered in 1906, near New Westminster, B.C., a large number of thriving trees have been raised in England. The Californian laurel (*Umbellularia californica*) attains a large size on alluvial flats in Oregon, where it produces a valuable furniture wood. This species in more southerly districts is often a mere bush, and care should be taken to get seed of it from its most northerly station in Oregon.

The Rocky Mountains region has yielded a few hardy trees, which are slow-growing but ornamental in our gardens, as *Picea pungens*, the Colorado form of the Douglas fir, *Abies arizonica*, *Abies concolor*, and *Cupressus arizonica*. The only tree of forestry importance from this region is *Larix occidentalis*. This is the finest of all the larches, attaining in Western Montana and the adjacent districts of Idaho and British Columbia a height of 160 feet and a girth of 15 feet, and yielding timber of magnificent quality. Introduced by seed for the first time in 1903 by Elwes, followed up by larger supplies in 1908 (consequent on my visit to Montana in 1906), this larch is now being extensively tried both in this country and on the Continent, but it is too

soon to judge of its merits. A few older trees, introduced as living plants in 1881 and 1889, have thriven well in the poor sandy soil of the pinetum at Kew; and during the past dry summer were conspicuous amongst the other species by their freedom from chermes, and their extremely healthy dark-green foliage. This tree would seem then to be best suited for a dry and continental climate, and should succeed in Great Britain on the eastern side of the country.

Of the eastern region of North America the only conifer of first-class importance from the point of view of forestry, *Pinus Strobus*, has recently, owing to fungus attacks, become difficult, if not impossible, to cultivate in Europe. The red pines, silver firs, spruces, larch and hemlocks from this region all make in the British Isles small trees, often ornamental, but of no value for the production of timber on a commercial scale. *Picea alba*, the white spruce, may be mentioned as occasionally being of use as a wind-break at high altitudes on poor soils. With regard to the broad-leaf trees of the Eastern region there is a curious law, the significance of which is not quite clear. In the case of genera which have a representative species both in Eastern North America and in Western Europe, the adaptation has been carried to such an exquisite point that the American tree is absolutely unable to grow in England. I may instance *Quercus alba*, which is closely allied to our *Quercus sessiliflora*. Thousands of pounds were spent, according to Loudon, on its introduction, both by acorns and by plants before 1838; yet only one white oak tree is known to exist in England—a stunted specimen at Tortworth, scarcely 20 feet high, which was planted many years ago. Similarly, *Fraxinus nigra*, the representative of the common European ash in Canada, is unable to live in Great Britain.

If, however, the American species belongs to a genus, or to a section of a genus, which is unknown in Western Europe, it grows well in Great Britain, especially in the south, where the summer is warm, dry and sunny; thus *Quercus rubra*, *Q. palustris*, *Fraxinus americana* and *F. biltmoreana*, and genera like Liriodendron, Liquidambar and Robinia flourish in the Thames valley. It is useless, then, to attempt to introduce trees like the American beech, American chestnut and American lime; but we may attempt with success the cultivation of the black walnut, as we have no native *Juglans*.

The number of broad-leaf species in the eastern region of North America is very great, and many yield valuable timber; yet very few are worth introducing into our commercial plantations. In certain circumstances, *Juglans nigra* (black walnut) and *Robinia Pseudacacia* may be planted with advantage. In some species the timber produced is inferior in quality and quantity to the allied native species. It is thus of no use attempting the cultivation of *Quercus rubra* and *Q. palustris*, which could not equal in any way the product of the English oak. Other species are economically useless on account of their slow growth and their rare production of seed, and this depends on the lack of sufficient summer and autumn heat even in the extreme south of England. For this reason all the hickories, the tulip tree, the two species of *Catalpa* and *Prunus serotina* are of no forestry importance in any part of the British Isles.

In one respect, however, the North American broad-leaf trees are of great interest to us. After their introduction into Europe, several species accidentally gave rise to hybrids that are now much valued by foresters and arboriculturists. The poplars that are invariably cultivated for commercial timber in France, Belgium and England are of hybrid origin, being crosses between the American *Populus deltoides* and the European *Populus nigra*. These remarkable trees, which display astonishing rapidity of growth, the black Italian poplar (*Populus serotina*), which originated about 1740, *Populus regenerata* (1814), *Populus Eugenei* (1832), and *Populus robusta* (1895), yield enormous quantities of cheap timber, being profitably grown around small fields devoted to hay and pasture.

The tree most commonly seen in London, *Platanus acerifolia*, is in all probability a cross between the American and Oriental species of plane, which originated some time before 1703, when it was first described by Tournefort. Remarkable hybrid walnuts have similarly originated in California during the last forty years owing to the growing together in orchards of three species, *Juglans nigra*, *J. regia*, and *J. californica*. One of these, of which I have received a photograph and measurements from the U.S. Forestry Bureau, Washington, has attained at 40 years old 100 feet in height and 15 feet in girth. Fast-growing trees like these hybrids, which produce in a short period a large volume of fine timber, are evidently destined to be of great importance in the timber production of the future.

27. Forest-Tree Growing in the South Island, New Zealand.

By R. G. Robinson, Superintending Nurseryman, South Island.

The above report is an extremely interesting one. It deals in a practical way with matters relating to afforestation on a large scale, and shows in a convincing manner that the problems of afforestation are being tackled with energy and resource in the South Island of New Zealand.

In explaining the purpose for which the report was written, the author in his introductory remarks says:

"The afforestation work conducted by the State in the Dominion has, since its initiation, received the whole-hearted support of many enthusiastic tree-growers; but with each succeeding year the increasing prominence of our young artificial forests has attracted the attention of the general public, who, on becoming enlightened regarding the annual progress made, not infrequently express their surprise at the magnitude of the undertaking.

"As might be expected, the presence of flourishing plantations of timber trees in the various districts throughout the Otago and Canterbury Provinces stimulates the desires of farmers and others to produce similar results, and officers of the Department are frequently called upon to supply such information as will materially assist intending tree-planters.

"Although certain rules for general guidance have been maintained since the inauguration of the Forestry Branch, it has only been through a sustained series of experiments, together with the introduction of new practical ideas from various sources, that the present measure of success has been attained.

"This condensed article on tree-raising methods adopted in the South Island nurseries and associated plantations is prepared with the object of conveying to readers information which recent correspondence and personal inquiries show is mostly solicited.

"By the actual observance of the various works in progress, however, more productive knowledge is gained than from any literary source, and departmental officers are ever ready to give a practical demonstration to those contemplating tree-planting.

"Whilst the effect of desired brevity and compulsory omission of much detail will be apparent throughout this paper, its object

will be accomplished, however, if a concise practical review of the leading items of labour essential in raising seedlings and creating plantations up to their present stage is portrayed."

The first subject dealt with in the report is that of tree seeds, concerning which the author gives some very sound advice. The collection of "home" seed in the island is as yet not practised on a large scale (about 8 cwt. of seed is required annually), owing to the expense of cone gathering and seed extraction, and also to the "questionable practice of tree-raising from seed, which has, perhaps, been taken from comparatively youthful trees." The last remark applies principally to trees of the pine, larch and silver fir genera. No difficulty is experienced in securing sufficient quantities of hardwood seed. In referring to the importance of selecting good seed trees, Mr Robinson reminds his readers that "well-bodied seeds from a healthy mature tree not only possess greater germinative qualities, but are also capable of enduring more adverse conditions after sowing, and each succeeding year the importance of this seed-selection receives more universal recognition. The possession of these facts has influenced the action of the seed-collectors for the Department in gathering only from specially selected trees."

The article concludes with the description of a few simple tests for seed quality.

The preparation of the ground for seed-sowing is next explained in a thoroughly workmanlike fashion. The seed-beds vary in width. They may be either 27 ins., 34 ins., 42 ins., or 72 ins., and between each bed an alley or path 21 ins. to 27 ins. broad is formed. The seed is sown in furrows which run in a longitudinal direction. These furrows are 12 ins. in width, and it is interesting to note that they are prepared by means of a grooved roller, the grooves in this case, however, being broader and placed at right angles to those of the Murthly type.[1]

The methods employed in tending the seed-beds, such as the special precautions which are adopted in watering and weeding, and the hardening off of the seedlings, are next carefully explained.

Under the next heading the author gives the result of his practical experience of the system known as "Wrenching." He says:

"The success we have achieved in transplanting young pines, evergreeens, and seedlings generally that produce lengthened

[1] See *Roy. Scot. Arbor. Trans.*, vol. xxix. part 1, plate ix., page 96.

tap-roots is attributed largely to a system of wrenching, which is performed by two employees, who are provided with specially sharpened spades. Each man stands on opposite sides of the drill being lifted, and by brisk foot-pressure drives the spade full depth at such an angle as will cleanly cut the roots near the extremity. By a gentle leverage on the spade-handles the soil containing plants is slightly raised, and on withdrawing the tools the crevices formed on each side are closed by tramping. This operation is usually conducted in the early autumn, so that sufficient time is given plants to recuperate; and transplantation is facilitated by the consequent formation of numerous fibrous rootlets in place of straight tap-roots."

In the three nurseries, namely, Tapanui, Ranfurly and Hanmer Springs, there are annually transferred to the nursery lines approximately 3,750,000 seedlings. As this operation has to be completed during the months of September and October by 36 employees, it is quite evident that the work must be done on a well-organised system. In describing the methods of lifting and lining-out the author goes on to say:

"Various rudimentary principles are generally acknowledged in dealing with the different kinds of trees raised, but the precise method chosen is regulated according to the vigour of seedlings. Such trees as larch, Oregon pine, oak, sycamore, walnut, chestnut, alder, ash, and some of the quick-growing pines—*Pinus radiata*, *Pinus muricata*, *Pinus Torreyana*, *Pinus Benthamiana*—are usually transplanted into lines when one year old, whilst it is customary to allow the less speedy growers—*Pinus Laricio*, *P. strobus*, *P. austriaca*, *Picea excelsa*, *P. sitchensis*—an additional year's development in beds before lifting. The simplicity in propagating and the comparative hardiness of *Pinus radiata* render it possible to raise these trees to a sufficiently strong state for permanent planting at ten months old. The young plants are carefully removed from the seed-beds during the latter part of summer, and lined out in the manner outlined below ere the advent of spring. The young pines have then become sturdier and possess a well-formed root-system. It is, of course, possible after a series of judicious wrenching to put the young pines out to the plantation direct from the seed-beds, but a big death-rate is usually the outcome in thus operating on exposed areas."

Before being lined-out the seedlings are assorted in groups of two or three sizes, one workman being able to assort 20,000 to

30,000 plants daily. The plants are then subjected to a light root-trimming with ordinary sheep shears, and carefully "puddled" as a protection against draught.

The lining-out breaks are on an average 3 chains long by $2\frac{1}{2}$ chains wide. The soil is then thoroughly worked to a depth of 12 ins., by a specially designed plough drawn by two horses. Mr Robinson emphasises the importance of thoroughly preparing the soil. After having been stirred up by the plough, the surface of the soil is levelled and broken up into a fine tilth. The planters then proceed to insert the seedlings along sighted lines by means of a bricklayer's trowel. The best planting distance has, after much experimenting, been found to be 10 ins. between the lines and $2\frac{1}{2}$ ins. between the plants in the lines. At this density an acre contains 246,000 seedlings with due allowance for borders and centre path.

As regards the transplanting age and the time the transplants remain in the nursery lines, Mr Robinson says:

"Amongst the varieties that develop sufficiently for transference to plantations when two years old may be mentioned larch, Oregon pine, oak, ash, sycamore, birch, alder, acacia, *Pinus radiata*, *P. muricata*; whilst an additional year's growth in nursery is usually allowed the slower-growing spruce fir, Sitka spruce, *Pinus Laricio*, *P. austriaca*, *P. strobus*, *P. ponderosa*. The adoption of a general planting rule is not rigidly adhered to in connection with the latter-mentioned trees, for at both Hanmer Springs and Ranfurly Nurseries yearling pines are lined-out most successfully, and permitted to occupy the same position for two years; whilst at Tapanui Nursery greater success is attained by transplanting two-year-old seedlings, and allowing only one season for development before permanent removal. Seedlings are conveyed in shallow boxes direct from the 'heeling-in' quarter to the planting-ground, and placed in convenient positions there. Every effort is made to conduct the lining-out work with workmen who have previously had special training, as some time must elapse before a casual worker becomes proficient or smart enough to hold his own along the line."

The labour required to keep the nursery free from weeds varies according to climatic conditions. The drier the season the less labour is involved. In any case Dutch hoeing is carried out between the lines for some weeks after the transplanting has been completed. The author goes on to say that:

"This has the effect of breaking the surface-crust, and paves the way for the later machine-hoeing. The manipulation of the small Planet wheel-hoe is extremely simple, and requires but little explanation here. The machine is fitted with six cultivator-teeth, 1 in. in width, three of which stir up the soil between each line. On fastening to the arch a light rope with handle-bar attachment, a workman is able to draw the hoe steadily all day without feeling the least fatigue. The hoe follows precisely the same course as the man in front—viz., straddling the line of trees; but the guiding of the machine is done by another workman, who holds the handles firmly, and walks along the last cultivated row, so that on the return journey his footprints are obliterated. The suppression of weed-growth close to young trees cannot be accomplished by the wheel-hoe method, as in attempting to run the cultivator-teeth very closely to the lines there is a decided risk of disturbing the root-system of the growing plants, with disastrous results. Hand weeding is thus resorted to.

"Employees are provided with small weeding-forks, and in a kneeling position extract by the roots all foreign weed-growth—principally sorrel, spurrey-weed, and shepherd's purse—which are deposited in rows about six lines apart. The weeds thus accumulated are then drawn into heaps and removed preferably by means of a hand-barrow."

In order to cause the plants to mature the season's growth and harden off, especially when growth is likely to be prolonged into late autumn, "wrenching" is resorted to. Mr Robinson's experience is that "there can be no question that checking the progress of late-growing evergreen and deciduous trees is helpful in bringing about the desired hardening-off state so necessary in tree-growing when carried on in districts where severe winters are experienced."

The following paragraph deals with the important operations of lifting and bundling the trees for transference to the planting ground:

"The distribution to State plantations, domains, etc., of an approximate 3,120,000 trees annually from the nurseries at Tapanui, Ranfurly, and Hanmer Springs necessitates tree-lifting being commenced immediately the season's growth has matured. We endeavour to make a start towards the latter part of April, but perhaps the presence of autumnal foliage on larch, rowan, or birch offers the most accurate guide as to how early the removal

of trees may be undertaken. The systems adopted in tree-lifting from nursery lines vary somewhat, for whilst one man may conduct the actual spade-lifting of small two-year-old trees, a correspondingly increased cost and labour are involved when dealing with more advanced stock. It is essential, however, that all trees must be loosened to such an extent that no mutilation of roots will eventuate when 'pulling-up' is being undertaken. The lifting of a line of medium-sized trees is expeditiously carried out by two workmen, who insert their sharpened spades on each side of the trees, some 5 ins. distant. On applying simultaneous foot-pressure the spades are driven down until they almost touch, cleanly cutting all roots that come into contact. After this treatment has been applied to several lines, a workman follows up the lifters, pulling up and counting into twenty-fives all well-developed trees. The employee in charge of the tying operation, having previously prepared a number of flax strips of required thickness and length, fastens a tie around each bundle, just above the collar. Bundles secured in this manner are then removed by hand-cart to the end of the 'break,' where they undergo a final root-trimming and puddling process. Tree-roots are shortened so that there is no liability of cramping when permanent planting is in progress, whilst the immersion in a puddle of soil and water has the far-reaching effect of protecting the root-system from exposure, generally so unavoidable during transit. All bundles are now temporarily heeled-in, and if the soil be well firmed the transference of trees to plantation may be delayed for a month or more without risk being incurred."

The actual transportation of the trees is effected by means of specially constructed hooded wagons. The number of loads delivered per day on the planting ground naturally varies with the distance and the state of the roads. Under certain conditions a team of five horses is required to draw the loads. The following paragraph is interesting as it indicates the cost of this method of transport:—

"When one considers the difference in size and weight between bundles of various trees grown, credence must be given to the fact that three-year-old oak are frequently six times more bulky, and therefore require a correspondingly greater amount of cartage, than pines of the same age. As many as 100,000 small two-year-old larch and pines have been conveyed to the planting-

ground in one load, whilst, on the other hand, 7000 oak have at times constituted a still heavier load. It is somewhat difficult to determine accurately what number forms an average wagon-load of trees of an approximate 25 cwt., but based on the past season's carting the number works out at 29,600, and the transport cost at 6¾d. per 1000 trees."

A considerable amount of trouble is caused by ground game. Wire-netting fencing is necessary to protect the plantations against damage by hares and rabbits, and precautions have to be adopted to keep both red and fallow deer in check.

The special methods adopted in dealing with forest fires and the precautions taken to prevent their origin are fully explained.

After dealing with the operations involved in clearing and draining the area to be planted the writer goes on to describe the methods adopted in preparing the pits for the reception of the trees. The following extracts will serve to give a good idea of the methods employed:—

"The following four distinct processes of ground-preparation are recognised, each one meriting its adoption as circumstances demand: (1) Spade-pitting, (2) grubber-pitting, (3) scuffling ground (or 'spotting'), (4) hole-boring.

"The first method is generally employed where the ground is easily worked, and either a No. 2 or No. 3 Black's spade may be used. All vegetation is cleared over a surface of 12 ins. to 14 ins. square, and the hole, measuring 8 ins. square and 10 ins. deep, with the front side sloped in such a manner as to reduce the bottom space of pit, is prepared in the centre. Where the soil is light it is customary to merely reverse the sod in the pit; but, when dealing with ground of a more argillaceous composition, the contents of the hole are placed on the front edge of the pit, where the action of rain and frosts reduces it to a pulverised and otherwise favourable state for placing against the tree-roots. In the early stages of our afforestation work slightly more than £1, 10s. per 1000 was paid for pit-making; but we are now able to carry on precisely similar work at 50 per cent. cheaper rate.

"In the second method a grubber-pick is used. A surface-clearing is made, as before mentioned, by a well-directed blow or two with the tool, after which a space of 12 ins. by 9 ins. is worked up roughly to a depth of about 10 ins., and allowed to remain in this state until the planting season arrives. Such pronounced success has attended repeated trials of this mode of

pitting that it is now being almost exclusively adopted at the South Island plantations. No difficulty is experienced in getting employees to undertake the grubber-pitting at from 12s. 6d. to 15s. per 1000, and at this rate an average wage of about 8s. 6d. per day is earned individually.

"In operating on light, porous, or gravelly soils with small plants, scuffling ground (or 'spotting') is frequently resorted to with fair results. This work consists of clearing a small space 12 ins. square, either with a spade or mattock, and is carried on by day-labour at 8s. 6d. per 1000. As the 'spotting' is inseparable from slit or bar-planting, much discretion must be exercised in selecting only the most favoured situations for this mode of pitting, and even then equal success with the previously explained system cannot rationally be anticipated, as no matter how carefully a plant is inserted in the crevice formed by the planting-bar or spade, the roots invariably assume a cramped, unnatural position.

"At Hanmer Springs (where prison labour is employed) a specially designed pitting-line has been used for some years, and very accurate work is performed, even by totally inexperienced men. Some 70 or 80 links, 4 ft. in length, are constructed from No. 16 gauge wire, and joined together. On this line being stretched across the pitting-ground in the desired direction, strained, and finally made secure at both ends, each prisoner takes his allotted place, and opens a similar number of pits immediately opposite the link-joints, after which the line is brought forward 4 ft., set parallel to the preceding one, and again pegged in readiness for pitting. Care is taken to have pits opposite each other in every other line. The daily number of spade-pits prepared individually by prisoners depends to a great extent upon the class of ground being afforested. On light easily worked soils as many as 700 each have been made in a day of eight hours; whilst on ground of a hard gravelly nature a similar amount of energy will be required to form 350 holes."

As regards the actual planting of the trees the author goes on to say:

"Before expressing definitely the recognised most suitable time for tree-planting, attention might be directed to the effect which our changeable climate has in the matter. In certain seasons abundance of moisture is available from the time of planting onwards, and prospects of success are still further

enhanced by the prevalence of a comparatively mild yet moist winter. Under these conditions the losses in planting-out rarely exceed 4 per cent., although when a severe winter is followed by almost persistent winds and a prolonged absence of moisture, it is not unusual to record as high as 8 per cent. in transplantation failures.

"Without a doubt greater problems have to be faced in conducting our work in Central Otago. Owing to the severity of winter frosts (on one occasion the thermometer registering as low as 14° F. below zero) which are at times responsible for completely lifting newly planted trees out of the ground, we endeavour to commence the planting-work at Naseby about the early part of August, by which time the surface-soil is relieved of frost. The conditions obtaining at Tapanui and Hanmer Springs Plantations are, fortunately, much milder, and actual planting is often entered upon before the end of April, and continued with occasional intermissions until the beginning of October, during which period between two and a half and three million forest trees are planted out.

"The mode of preparing pits having already been alluded to, a few brief remarks will be sufficient to explain the planting in operation. Where practicable a light spring dray is used to convey trees from the temporary depots to the planters; but the hilly and otherwise rough nature of a great proportion of the ground being planted makes it necessary to employ a packhorse, which, with heavy woven baskets, one on each side of the saddle, is able to distribute from conveniently arranged trenches a sufficient number of trees to keep from fifteen to twenty planters fully occupied. By keeping a record of trees thus dealt out, the employee in charge of the packhorse or dray is able to check the number of trees planted daily. For carrying trees, canvas bags, 17 ins. long and 14 ins. wide, with shoulder-straps, have given most satisfaction.

"Although tree-planting was in former years carried on by two operators (one holding the plants and the other using the spade), the equally effective and certainly more economical method of single planting is now employed.

"The adherence to the following points, as a rule, is maintained, although at times deviations are both necessary and desirable. Assuming that tree-planting is being carried out in grubber-pits: By a well-directed blow or two with the spade an

upright back is formed on the side away from the prevailing wind, and on withdrawing the spade a sufficiently deep crevice is opened to insert comfortably the roots of the trees straight down. The planter—holding the young tree in one hand, with its root-collar on a line with the ground-surface—presses the most pulverised soil available against the roots, and by applying foot-pressure makes the young trees perfectly firm and more able to withstand the injurious effects of high winds.

"At each plantation this class of planting is carried on by day-labour, at an average cost of 10s. 5d. per 1000, each man being able to plant from 700 to 800 daily without undue exertion. At Conical Hills Plantation, where rough steep hillsides are being afforested, over a million trees were planted by contract last season under this system at 12s. 6d. per 1000. Specially careful supervision is essential during the progress of any contract work, although the result of the experiment justifies its repetition.

"Spade-pit planting has been principally carried on at Otago Central and Hanmer Springs Plantations, and at the latter station the prisoners employed ofttimes make excellent planting tallies, which, under fair conditions, not infrequently reach 800 per man daily.

"It invariably happens, in operating over large areas of ground, that small portions of a light or stony nature are encountered. The 'notching' or 'bar-planting' methods, which are the cheapest forms of planting recognised by officers, are then frequently introduced with advantage. A planting-bar, which is about 5 ft. in length, weighs 8½ lbs. The handle is made of ¾ in. gas-piping, to which is welded a wedge-shaped steel-pointed foot 10 ins. long and 4 ins. across the top, tapering to 2 ins. at the extremity. In manipulating the bar on scuffled spots prepared, the operator, by two or three driving movements, forces the tool into the ground some 9 ins. deep, and by working the handle backwards and forwards a crevice is formed, into which the young plant is thrust. The opening is then closed by again driving the bar into the ground a couple of inches distant, and prizing the soil towards the plant. In computing the average cost of dealing with trees by this or the similar spade-notching—about 8s. 6d. per 1000—allowance must be made for the rough nature of the surface generally associated with dibbling and notching work. Failures in transplanting by bar are often

traced to the omission of the necessary final heel-firming, without which no great success in any method will be realised."

The following condensed remarks are of much interest as they refer to trees with most of which Scottish foresters are already familiar:—

"The impossibility of explaining thoroughly in the limited space available the planting-systems in vogue and ultimate results anticipated will perhaps be apparent to readers. Touching lightly on a subject of almost paramount importance in tree-growing for profit has, too, a tendency to confuse rather than educate one desirous of receiving a general idea of how the work is being conducted. It is, however, desirable to make a few abbreviated references to our present position, without dwelling too freely on the more speculative future thinning, under-planting, felling and timber utilisation.

"By judicious blending of our practical knowledge of the requirements of the country, extending over fifteen years, with advanced Continental practices, it is not a very difficult matter to determine appropriate modes of associating various trees in plantations.

"Adverse criticism on some of our earlier experimental labour is occasionally uttered by persons who evidently fail to realise that without such experiments a suitable general working basis would never be arrived at. Much knowledge has been gained regarding association of trees and afforestation work in the various stages by private planters, who do not hesitate to diffuse any information solicited by the departmental officers, and in this way also help to lighten the experimental work.

"No matter from what point of view the study of planting-systems is taken, high-forest stands out pre-eminent in being specially adapted here for the raising of timber of a desired marketable size. This high-forest system, which may be arrived at by a judicious mixture of varieties suitable for the existing soil and climatic conditions, or by planting suitable light-demanding varieties pure, and eventually introducing shade-enduring species after thinning has been commenced, is now being adhered to. In the first place, close planting is absolutely necessary for ground-protection and the inducement of straight branchless boles. Certain varieties exhibit greater tendencies to produce strong lateral branches—such as *Cupressus macrocarpa*—and naturally these varieties should be confined to an unusually

small growing space—about 3 ft. apart. On the other hand, the forceful nature of the leaders of *Eucalypti* make it possible to attain equally satisfactory results by planting these as much as 6 ft. to 7 ft. between each tree.

"The light-demanding *Larix europæa* constitutes one of the most important varieties at present being grown. It is easily raised and transplanted, and up to quite recently has shown decided partiality for all situations tried. Most writers affirm that the growing of a thoroughly healthy crop of larch is a sylvicultural impossibility, owing to its susceptibility to a fungoid disease. There is no doubt that in mixed planting the liability to disease is more remote; but repeated experiments in associating larch in their youth with other trees of commercial value have clearly indicated the undesirability of substituting our present pure planting for any mixed system.

"At the present time larch is planted at 4 ft. apart, and we anticipate being able to conduct the first thinning operations—which will merely consist in removing the dominated or suppressed trees—when plantations are from fifteen to twenty years old. From that time onward periodical thinnings will be undertaken, and be followed by the gradual introduction of shade-bearing species of the Oregon pine or *Thuja plicata* types. Such trees as *Picea excelsa*, *Picea sitchensis*, *Pseudo-tsuga taxifolia*, *Fraxinus excelsior*, *Quercus pedunculata*, *Pinus austriaca*, *Pinus Laricio*, *Pinus ponderosa*, and *Pinus strobus* have been planted pure in suitable localities; but in the cases of the thinly foliaged trees under-planting will subsequently have to be resorted to.

"Several large compartments have been filled with a mixture of English ash and spruce fir, and although both varieties have proved intensely slow growers in their youth, where the soil is of good fertility a uniform progress is being maintained. For the ultimate crop *Pinus ponderosa* is being nursed by *Pinus Laricio*, and both species are keeping well together. The yellow pine, however, being the most valuable tree for succeeding under adverse conditions, is generally allotted the more exposed rocky situations where pure planting is followed.

"The Department has practically ceased raising the undesirable *Acer pseudo-platanus* and *Acer saccharum*, both of which have proved to be utterly unsuitable for planting, even on semi-sheltered hillsides. In several deep gullies sycamore are making excellent progress; but as the more valuable ash also

thrives under these conditions, the latter tree is now receiving preference. The swaying influence of winds on trees becomes more pronounced the higher the altitude.

"Although we endeavour to partially restrain this ill effect by planting double lines of fast-growing shelter-trees—*Pinus radiata* or *Pinus muricata*—where practicable, little or no assistance in this direction can be rendered those trees occupying positions upon steep exposed hillsides."

Under the heading "Labour and Supervision" Mr Robinson has some interesting remarks to make, as the following extracts will show:—

"The raising of about three million trees and afforestation of 1025 acres annually, together with the allied maintenance-labour in pruning, etc., the previously planted 3612 acres, involves an outlay of some £7670, and provides employment throughout the year for an average number of sixty-four men. These figures, however, do not include prison labour, which is confined to the Hanmer Springs station, where the hearty co-operation of the Justice Department is responsible for the substantial saving effected in dealing with the permanent planting work there. After due allowance is made for domestic and camp maintenance duties, about ten prisoners are available, and the annual value of their tree-planting work may be computed at £75 per man. The total expenditure thus devoted to afforestation in the South Island section may be more accurately set down at £8067.

"The gaolor in charge at Hanmer Springs camp is responsible to the Justice Department for the welfare of the prisoners: and on becoming acquainted, through the plantation foreman, with the desires of the Forestry Branch, apportions a warder to each working-gang of from four to ten prisoners, according to the nature of the labour undertaken and the numerical strength of the camp.

"Much aid is rendered the plantation foreman by warders, who soon become competent overseers, and, as a rule, willingly assist in keeping the records of work daily performed.

"By the inclusion on the staff of one or two men skilled in carpentry, horse-shoeing, blacksmithing, and saddlery-work much time is saved, besides providing steady employment to those who would otherwise be idle through wet weather. As a rule, very little difficulty is experienced in securing the desired number

of tree-planters, although during the harvesting and shearing periods specially attractive offers from farmers occasionally induce our employees to temporarily leave the service of the Department, only to find on again making application that the vacancy thus created has been filled."

The aim of this very able report is to show in as condensed a form as possible what has already been accomplished by the Department. It is profusely illustrated by excellent photographs which show very clearly every phase of the work involved from the nursery to the completed plantation, and a study of these plates indicates in an unmistakable manner how efficiently that work is being done.

28. Note on the Occurrence in Scotland of *Megastigmus pinus* in the Seed of *Abies nobilis*, Lindl.[1]

By James Fraser, B.Sc.

The Chalcid Family of the Order Hymenoptera contains a very large number of species, the great majority of which are parasitic on other insects. Some species, however, are phytophagous in habit, and of these, several, belonging to the subfamily Megastigminæ and the genus *Megastigmus*, lay their eggs in seeds: in these seeds the larvæ hatch and feed so that the seeds are ruined. Pupation of the full-fed larvæ takes place under cover of the hollowed-out seed, from which, when ready, the adult insect issues by a hole.

Of *Megastigmus* species that infest conifer seeds three have been recorded in Britain:—

Megastigmus pinus, Parfitt, of this note;
Megastigmus spermotrophus, Wachtl.; and
Megastigmus strobilobius, Ratz.

Megastigmus spermotrophus was first described as a new species by Wachtler of Vienna, in 1893, the insects having issued from the seeds of the Douglas fir. In 1906 this insect was recorded by Dr MacDougall here in the seeds of Douglas fir from Aberdeenshire where the insect had proved very destructive. Later, in 1909, the species was recorded by Crosby in a bulletin from Cornell University. The seed from which he obtained his

[1] Reprinted from *Trans. Bot. Soc.* Edin., vol. xxvi., part 4.

specimens came from Colorado, the home of one variety of the Douglas fir.

M. strobilobius was first recorded by Ratzeburg in 1848 from seeds of *Abies pectinata*. It has been recorded in the United States by Crosby. In Britain it has been found by Mr A. C. Forbes and has been described by Mr Gillanders.

Megastigmus pinus, Parfitt.—This species was first described by Parfitt in 1857. Various coniferous species had been named as hosts of the species, but there are authentic records of its living in the seeds of *Abies nobilis*. In the National Collection at the British Museum, in addition to the 1857 record, there are two records: one of two males and two females from Mr A. Murray, and a British record in 1904 of specimens received from Wm. Vicary, Esq. The present record is of a female specimen from the seeds of *Abies nobilis*. It was found dead on 9th July among some seeds which were to be used as a museum exhibit. The occurrence of the insect suggested an examination of the seed for traces of damage. Out of 110 seeds, four were found which had certainly been attacked by an insect grub. A dissection of one of these seeds showed it to be completely destroyed; a small amount of frass was left within the empty shell. The seeds among which those damaged individuals were found were sent over by a firm of German nurserymen in Hamburg. Present circumstances render an inquiry about the locality of the seed impossible. The fact that home collected seeds in this country germinate freely render it possible that they were from German-grown trees.

Abies nobilis seeds do not retain their power of germination for more than one winter, and they are sensitive to drought. These facts would probably point to October 1913 as the date on which the seeds were collected. The record and the specimen are of interest as there are at present no details of the insect's biology: it is possible that it may direct attention to the cause of the damage. Material and information which will help to complete the life-history would be welcomed.

Abies nobilis as a park tree is well known, and varieties of it are highly valued on account of their very beautiful appearance. In such trees the occurrence of the insect named would be of comparatively small importance. The tree in its own country is valued on account of the timber, which is sometimes sold as larch: it is, for indoor work, equally valuable, but does not

possess such durability or strength. In this country it is fairly common in small plantations. It is possible that the yield of seed from these might be seriously affected by the insect. A comparison of the area of distribution of the Douglas fir and of *Abies nobilis* shows that a very considerable part of the areas is common to both. It would be natural to conclude that the home of the Douglas is also the home of its seed parasite, and both have adapted themselves well to conditions in this country. The seed parasite of the Douglas is now a well-known enemy: a similar adaptation of host and parasite may result in the case of *Abies nobilis* unless a suitable remedy can be found and applied.

I desire to thank the Rev. James Waterston (Imperial Bureau of Entomology) for so kindly informing me of the previous records, and also Dr Stewart MacDougall, for directing me in my search for the identity of the specimen.

29. Note on Beneficial Insects.

By R. Stewart MacDougall, M.A., D.Sc.

In the war against injurious insects natural aids are present in mammals, birds, insects and fungi. The so-called Beneficial Insects are sometimes distinguished into those which are predaceous, moving about in search of insects which they devour, and those which are parasitic, feeding externally on the host insect or living inside the host insect, and, by feeding at its expense, destroying it.

Predaceous insects are represented by different Ground Beetles (Carabidæ) and their larvæ; by Rove Beetles; by beetles like Clerus and Rhizophagus and their allies; by ladybirds and their larvæ; by the larvæ of Hover-flies; by adult Robber Flies; by the larvæ of the lacewings; and by some Heteroptera. Some of the above insects have been imported from one country to another as a means of fighting some injurious species, and sometimes with distinct success. One of the most successful of such importations was the introduction of an Australian ladybird (*Vedalia cardinalis*) to California. The orange groves of California were being ravaged by the Fluted Scale, an accidental importation from Australia. When the orange growers seemed likely to be ruined a number of *Vedalia cardinalis* beetles were

imported from Australia to California, and then many more were bred. These ladybirds were set free here and there in the orange groves; they started to feed on the Scale; soon they mastered the Scale, and now successfully keep it in control. There have been further successful importations to New Zealand, the Hawaiian Islands and Portugal. Certain favouring reasons made the importation of this ladybird successful above the average.

Parasitic insects belong chiefly to two Orders—the true flies or Diptera and the membrane-winged insects or Hymenoptera. In Diptera, flies of Tachinid species are very useful, a large number of caterpillars—Moth Caterpillars and Sawfly Caterpillars —being destroyed by the Tachinid larvæ. For example, if one collects a number of the pupæ of the Magpie Moth a certain percentage of Tachinid flies will come away instead of Magpie Moths; or if one collects cocoons of the Large Larch Sawfly, some of the cocoons will yield not sawflies but Tachinids.

It is to Hymenoptera, however, that most parasitic insects belong, and chiefly to three nearly-related Families of the Order—the Ichneumonidæ, Braconidæ and Chalcididæ. The adults of these Families (there are some exceptions among the Chalcids, *e.g.* *Megastigmus* and *Isosoma*) lay their eggs on or in other insects, in the egg, or on or in the larva or pupa, and the larvæ on hatching feed at the expense of the insect parasitised, destroying the egg or so interfering with the growth or development of the host as to bring about its death.

It is often difficult to estimate the part a native parasite plays in checking increase of the species it parasitises. In ordinary years, and without man's interference, the numbers of a species remain about the same. Then conditions appear which so favour a destructive species that its numbers come to be far above the normal. The parasites of this species, favoured by the extra numbers of the host insect, increase in their turn until the numbers of host and parasite come again to be about the normal.

Practically every insect has its parasitic enemies, and entomologists expect to find some insects, in every brood they rear, parasitised. During the last year or two I have had occasion for class purposes to rear the Pine Sawfly, the Large Larch Sawfly, the Large Cabbage White Butterfly, the Carrot Fly, the Frit Fly, the Bluebottle, the Pine Beetle, and in every case parasites were got, several of the insects having more

parasitic species than one. The ravages of the caterpillars of the Large Larch Sawfly on larch have caused this insect to be studied from the standpoint of its parasites, and the observations of Gordon Hewitt, Mangan, Wardle and others have shown that in Britain at least eight different Ichneumonidæ and one Braconid may be reared from Large Larch Sawfly material. To this list has to be added another Braconid and four Chalcids in America. Some of these insects are few in number, but two at least are in numbers sufficient to have an economic importance.

The Ichneumonid *Mesoleius tenthredinidis* has in some districts greatly reduced the number of the Large Larch Sawfly, and as a means of fighting this sawfly great numbers of this parasite have been set free in other districts in Britain under the supervision of the Board of Agriculture and Fisheries, while Gordon Hewitt has imported the parasite into Canada.

Nowhere has the study of parasitism as a factor in the destruction of injurious insects been studied with so much thoroughness as in the United States. Two European insects, very destructive to trees—the Gipsy Moth and the Brown Tail Moth—have been accidentally introduced to America and have done enormous damage. This led to a study of the European parasites of the caterpillars of these two moths. The result has been not only a mass of important and interesting scientific information, but the importation and colonisation of a number of useful parasites. In India also there are successful records following on the importation of a parasite.

The problem is often a complex one. One must not hastily assume that all the Ichneumonids and Braconids and Chalcids associated with an injurious species of insect are parasitic on that species. Some are, and others are likely to be, parasitic on the parasite. If an injurious insect be parasitised by more than one species, then these two parasitic species compete with one another. Again, if the parasite be parasitised in turn the numbers of the useful species will be reduced.

Annihilative measures adopted against an injurious species of insect are often practised without consideration of the effect of these destructive measures on the parasites. The destruction of the caterpillars of the second brood of White Cabbage Butterflies—a brood generally much parasitised—will carry with it the destruction of the useful parasites. It would be better if the collected caterpillars could be so confined that

wandering was impossible for them, and yet the arrangement be such that any parasites on issuing might obtain their freedom. Following such a plan, Decaux collected masses of unopened apple buds spoiled by the grubs of the Apple Blossom Weevil (*Anthonomus pomorum*), and instead of destroying these with their contained grubs, he so arranged them that any parasites could issue, with the result that 250,000 parasites escaped.

The foregoing note is given because of work which is at present in progress in connection with a parasite of *Hylobius abietis*. Our foresters know well what an amount of destruction this weevil can do in conifer nurseries. Two years ago, Mr James Munro,[1] while collecting in Aberdeenshire, found parasitic grubs feeding on *Hylobius* larvæ. The adults on being bred out proved to be Braconids, similar to one which the late Dr Nisbet had obtained in the West of Scotland. Mr Munro has been working at these Braconids for some time now, and experiments are at present in progress in the laboratory and in the field. Apart from the scientific interest attaching to the work, it is possible that the parasite may experimentally be found useful in the war against *Hylobius*. Too much must not be expected however, as the inquiry may show that the Braconid parasite is already widely distributed in Scotland.

The Boards of Agriculture are interested in the inquiry, and are encouraging and sympathetic towards the work. One of the points of the inquiry is to determine the distribution of the parasite, and in this work the members of our Society can greatly help. Already we have records of the Braconid from five counties. Even if it turns out that this parasite is generally distributed, by breeding it in numbers in the field it may be practicable to distribute it in a district where it is not known to be present or abundant, and so reduce the numbers of *Hylobius abietis*.

[1] Cf. p. 144 of the present issue.

30. The Canker of the Scots Pine caused by *Dasyscypha subtilissima*, Cooke.

(*With Plate.*)

By A. W. Borthwick, D.Sc., and Malcolm Wilson, D.Sc., F.L.S., Lecturer in Mycology in the University of Edinburgh.

During recent years several accounts have been given of the occurrence of the larch canker on various species of *Pinus*. Hopkinson[1] has recorded its occurrence on *Pinus laricio*, and points out that it may also be found on *P. sylvestris* and *P. austriaca*. Massee[2] has also recorded its occurrence on the Scots and Austrian pines as well as on the silver fir.

Our present knowledge goes to show that the fungus is not of infrequent occurrence on the above-mentioned species. It must, however, be borne in mind that *Dasyscypha Willkommii* is not by any means the only species of the genus which produces canker on these trees, and it is possible that some confusion has arisen owing to the great resemblance which exists between the fructifications of the several species which cause disease in conifers.[3]

Lagerberg[4] has recently pointed out that in Sweden *D. fuscosanguinea*, Rehm, produces a canker on the pines which closely resembles that caused by *D. Willkommii* on the larch. This species, however, has not been recorded in this country up to the present. *D. caliciformis*, Rehm, has been shown by Wagner[5] to be parasitic on *Pinus sylvestris*, *P. excelsa* and *Abies pectinata* in Germany.

[1] "The Occurrence of Larch Canker (*Dasyscypha Willkommii*) on the Austrian Pine," *Quart. Journ. of Forestry*, vol. vii., p. 287, 1913.

[2] "Larch and Spruce Fir Canker," *Journ. Bd. of Agric.*, vol. ix., p. 176, 1902.

[3] *D. calycina*, Fckl., a saprophytic species, has been looked upon by some investigators as identical with *D. Willkommii*. Both Hartig and De Bary, however, considered the two species to be distinct, and their independence has been recognised in recent lists of British fungi.

[4] "Studier öfver den Norrländska tallens sjukdomar, Sarskildt med hänsyn till dess föryngring." (Studies on the Diseases of the Northern Pines with special reference to their Regeneration.) *Mitteil. a.d. forstl. Versuchswesen Schwedens*, Heft 9, 1912, S. 135.

[5] "Beiträge zur Kenntniss der Pflanzenparasiten, *Zeit. fur Pflanzenkrankh.*, Bd. vi., p. 321, 1896.

Two species, *D. resinaria*, Rehm, and *D. abietis*, Sacc., occur on *Picea excelsa* in Britain, both of which are indistinguishable by the naked eye from *D. Willkommii*. *D. resinaria* has also been recorded on *Larix europæa* and *Pinus excelsa*, and, in the United States, on *Abies balsamea*.

D. subtilissima, Cooke, another species closely resembling *D. Willkommii*, appears to be not uncommon in Scotland. It was first described by Cooke,[1] "on the bark of firs in Scotland." It has been found in abundance, apparently as a saprophyte on *Pinus sylvestris*, in the Tynehead district (Midlothian). Recently a specimen producing a characteristic canker on the Scots pine has been received from Carmichael (Lanarkshire). Mr G. Mowat, who sent in the specimen, supplies the following particulars. "The plantation from which the tree was taken is situated at a slight elevation on a fairly dry gravelly soil with a good covering of rough grass. It is enclosed with rabbit-proof netting. It was formed in 1906 with 2-year 2-year plants of Scots pine, and these were notched in. The average height of the trees is now about 7 feet. A few larches are mixed with the pines, but only two or three of these are attacked by the larch canker. The wound on the specimen was about 6 inches from the ground, and was not quite clear of the rank grass."

The canker extends about half-way round the trunk, and has produced a flattening and consequent constriction of the stem as a result of partial or complete stoppage of cambial activity in the infected area (Plate XIX. Figs. 1 and 2). The canker is in an early stage of development and generally resembles that produced on the larch by *D. Willkommii*. The distribution of the fructifications is, however, rather unusual; while in the case of the larch these are generally found towards the outer parts of the canker. In the present specimen they are grouped towards the centre of the diseased area (Fig. 1).

The ascigerous fructifications (ascophores) closely resemble those of *D. Willkommii* in size and appearance, but as a general rule they possess slightly longer stalks. There are, however, striking differences in the asci of the two species, those of *D. Willkommii* being about twice the size of those of *D. subtilissima*.

[1] *British Fungi*, *Grevillea*, vol. iii., p. 121, 1874-5.

The points of distinction are given below :—

D. Willkommii. Asci subcylindrical, 120 – 140 × 10 – 12 μ; ascospores oval, 18 – 25 × 6 – 8 μ; paraphyses slightly longer than the asci.

D. subtilissima. Asci narrowly cylindric-clavate, 65 – 70 × 7 – 8 μ; ascospores slightly curved, 8 – 10 × 2 μ; paraphyses equal in length to the asci.

The asci and spores of the two species are shown in Plate XIX. Figs. 4 (*D. subtilissima*) and 5 (*D. Willkommii*), which are drawn at the same magnification.

The conidial fructifications of *D. Willkommii* have been often described, but it appears that up to the present no account of those of *D. subtilissima* has appeared. The pillar-like conidial fructifications of the latter species are smaller than the ascophores, being about 1 mm. in height (Fig. 3, *b*). The lower portion is white, and this is surmounted by a head of a dark yellow colour. The fructification is in reality in the form of a stalked irregularly shaped cup, which is completely filled up with a yellow mass of minute ellipsoidal conidia, measuring 3 × 1 μ (Fig. 6). The interior of the cup is entirely covered with a layer of minute branched conidiophores which bud off the hyaline conidia from their apices (Fig. 7).

D. subtilissima has been recorded by Massee on *Abies pectinata* and *Larix europæa.* A specimen on larch received by Greville in 1822 from Sir A. Jardine of Jardine Hall, Dumfries, and identified by Cooke, is preserved in the herbarium of the Royal Botanic Garden, Edinburgh. While writing this account, specimens on *Pinus Thunbergii* and *Pinus densiflora* have been received from Dunkeld from Mr J. Murray, and on these the fungus has produced cankers of the usual kind.

The occurrence of *D. subtilissima* on several host species is of considerable importance, since it is probable that the fungus can pass from one species to another. Experiments are being carried out to determine whether the larch can be infected by the fungus from the Scots pine, and if these are successful the possibility of such infection may lead to a modification in our views on the occurrence and distribution of the larch disease.

FIG. 1.

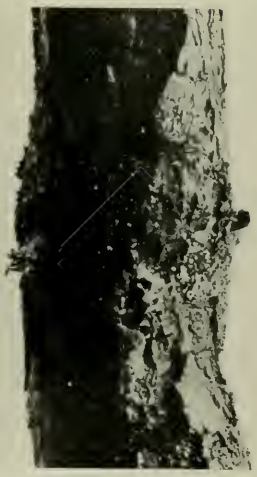


FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

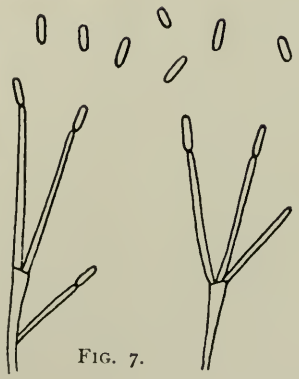


FIG. 7.

For explanation see text, p. 187.

[*To face page* 186.

We desire to thank Messrs J. Murray and Mowat who have kindly forwarded specimens of the fungus.

Explanation of Plate.

Fig. 1. Photograph of stem of *Pinus sylvestris* showing cankered area and fructifications of *Dasyscypha subtilissima*, Cke., about half natural size.

,, 2. Photograph of side view of specimen seen in Fig. 1 about half natural size.

,, 3. Photograph of part of cankered area showing (*a*) ascigerous and (*b*) conidial fructifications of *Dasyscypha subtilissima*, Cke. (× about 3).

,, 4. Ascus of *Dasyscypha subtilissima*, Cke. (× 400).

,, 5. Ascus of *Dasyscypha Willkommii*, Hartig (× 400).

,, 6. Median longitudinal section of conidial fructification of *Dasyscypha subtilissima*, Cke. (× 28).

,, 7. Conidiophores and conidia of *Dasyscypha subtilissima*, Cke. (× about 1100).

31. The Two Rust Diseases of the Spruce.[1]

(With Plate.)

By A. W. Borthwick, D.Sc., Advisory Officer for Forestry to the Board of Agriculture for Scotland, and Malcolm Wilson, D.Sc., F.L.S., Lecturer in Mycology in the University of Edinburgh.

Chrysomyxa Rhododendri, De Bary. The Spruce Blister Rust, Rust of Rhododendrons.

Chrysomyxa Rhododendri was first recorded in Britain by D. A. Boyd in June 1913, who discovered the uredospore and teleutospore stages on *Rhododendron hirsutum* at Douglas Castle, Lanarkshire.

Shortly afterwards, in October 1913, material of the aecidial stage of the fungus on *Picea excelsa* was sent for identification to one of the writers from the south-west of Scotland, and its discovery was recorded in the *Proceedings* of the Botanical Society of Edinburgh in June 1914.[2]

The life-history of this species was first described in 1879 by De Bary,[3] who showed that the forms previously known as *Aecidium abietinum* and *Uredo Rhododendri* were stages in the

[1] Reprinted from *Notes* of the Royal Botanic Garden, No. xli., 1915.

[2] *Proc. Bot. Soc. Edinburgh*, vol. xxvi., p. xxxiii., 1913–14.

[3] *Bot. Zeit.*, Bd. xxxvii., p. 761, 1879.

development of one species to which he assigned the present name.

This species is found frequently in the Alps wherever the Alpine Rose (*Rhododendron hirsutum* and *R. ferrugineum*) occurs. The yellow clusters of uredospores are developed in September on the lower surface of the leaves and also on the bark of the shoots of the previous year. The uredospores are oval in form and are produced in chains; they may further propagate the disease on the rhododendron. Slightly later the development of the teleutospores commences, and in the following spring the sori appear as small dark red cushions on the lower surface of the leaf.

The teleutospores are formed close together in groups covered by the epidermis, and each spore consists of a series of superimposed cells. A section of a mature sorus is shown in Plate XX. Fig. 1. Immediately before germination the epidermis is ruptured and the terminal cell of the teleutospore, the only one capable of germination, gives rise to a four-celled promycelium, each cell of which produces a sporidium. The sporidia are set free in June, and if they alight on the young leaves of the spruce may cause infection. A well-developed mycelium is produced in the leaf, and the infected area becomes yellow in colour. In some cases almost the whole of the leaf is infected, but generally the fungus is confined to certain zones and the remaining portions retain their normal green colour. As a result of infection small yellow spermogonia are first produced, and these are soon followed by the aecidia. Each aecidial sorus is surrounded by a long white pseudoperidium which, in the early stages, completely encloses the spores. The aecidiospores are arranged in chains and are produced from the base of the aecidium; they are orange-yellow in colour. At maturity the pseudoperidium breaks down at its apex and allows the aecidiospores to escape as a powdery orange-yellow mass. Before dehiscence the pseudoperidium has the form of a cylinder terminated by a rounded cone and possesses a yellow tint due to the colour of the enclosed spores. After the spores are shed the form is that of an open cylinder and the pseudoperidium is perfectly white. The aecidiospores are distributed by the wind, and if they alight on the leaves of the rhododendron are capable of producing infection.

The material of the aecidial stage of the fungus was obtained

in October, some time after its maturity, and the greater part of the spores had already been shed. An examination showed that in addition to the aecidia small yellow spermogonia are present. The number of aecidia present on a leaf varies.

Fig. 2 is from a photograph of a leaf bearing two pseudoperidia; several other aecidia were present, but the pseudoperidia surrounding them had fallen away. The pseudoperidium consists of a single layer of thick-walled pitted cells with strongly verrucose walls (see Fig. 3. in which the upper cells are shown in surface view and the lower in optical section). The aecidiospores are subglobose or ellipsoid, usually with a somewhat flattened side $20-24 \times 20-23$ μ in size. The wall is strongly verrucose and pitted except at the flattened portion; Fig. 4 shows a spore in surface view, and Fig. 5 one in optical section. The peculiar flattening of the aecidiospore depends on its method of development. Numerous rows of cells are produced in the young aecidium, and in each row only every alternate cell gives rise to a spore. The intermediate cells which do not produce spores remain thin-walled and at maturity become gelatinous and almost disappear. The flattened part of the wall of the aecidiospore is the portion which was originally in contact with the intermediate cell below it, and, in some cases, the shrivelled remains of this cell are still attached and may be seen as a black line when the aecidiospore is seen in optical section (Fig. 5).

In districts where the spruce does not occur it is probable that the fungus may exist through the winter in the form of hibernating uredospores, which, in the following spring, can infect the rhododendron; it appears therefore that the presence of the spruce is not essential to the continued existence of the fungus. The aecidial stage on the spruce, however, can only exist where the rhododendron is present, as the infection of the needles is only brought about by the sporidia. Since this is the case, the removal of the rhododendron will completely check the disease.

It appears, therefore, that the spread of the disease on the spruce will be limited in this country since *Rhododendron hirsutum* and *R. ferrugineum*, although frequent in parks and gardens, are not usually grown in plantations. The fungus has been found on *R. dahuricum*, but does not attack *R. ponticum*, *R. catawbiense*, nor their hybrids, which are so commonly grown.

The effect of the disease on the rhododendron is not serious; on the spruce the diseased needles fall in the summer of infection, and in severe cases the trees may be almost stripped of foliage.

CHRYSOMYXA ABIETIS, Wallr. The Needle Rust of the Spruce.

Chrysomyxa abietis was first recorded in Scotland by Somerville,[1] from Durris near Aberdeen, and, writing in January 1915,[2] the same investigator stated that up to that time he had received no further reports of its occurrence. A quantity of the fungus was recently obtained from Aberdeenshire, and in view of the omission of this species from recent works on British Uredineæ, as well as of its importance as a disease of the spruce, further inquiries as to its distribution in Scotland have been made.

Professor Trail has kindly forwarded the following information:—

"It is not more than six or seven years ago that I first observed *Chrysomyxa abietis* in Aberdeenshire, and it is probable that the fungus has only recently made its appearance in the north of Scotland. I have seen trees attacked by the disease in the Monymusk and Farland districts. The disease is now also very common in the spruce woods on the banks of the Findhorn, where it was first noted some three or four years ago by Mr William Watt, Assistant Forester on the Moray estates. When the infected trees in this locality are standing singly and foliaged to the ground, only the leaves on the lower branches are as yet attacked."

Mr P. Leslie, Lecturer in Forestry at the North of Scotland College of Agriculture, informs us that *Chrysomyxa abietis* is stated to be quite common on the Novar estate, Ross-shire.[3] It is evident, therefore, that the disease is spreading to a considerable extent.

Chrysomyxa abietis, which is widely spread in Switzerland and Germany, is an autoecious species completing its life-history on the spruce. It differs from *C. Rhododendri* in producing only one kind of spore, the teleutospore. The hibernating teleutospores germinate about May and produce sporidia which

[1] *Quart. Journ. Forestry*, vol. v., p. 277, 1911.

[2] *Quart. Journ. Forestry*, vol. ix., p. 68, 1915.

[3] In material from Novar the *Chrysomyxa abietis* is itself attacked by the parasitic fungus *Darluca Filum*, Cost. Further investigations will be carried out to determine how far it is possible to check the ravages of the disease by inoculation with this parasite.

infect the young leaves of the spruce. An abundant intercellular mycelium is developed in the tissue of the leaf which sends haustoria into the cell cavities. The hyphæ contain numerous yellow oil-drops, and in consequence yellow bands appear on the leaf. Soon afterwards teleuto-sori are produced which take the form of elongated yellow cushions on both the under surfaces of the leaf (Fig. 6). During the winter the sori are covered, but in the following spring the epidermis is ruptured and the teleutospores project as an orange-yellow mass (Fig. 7). Each teleutospore is cylindrical and consists of 8-12 superimposed cells of which only the terminal one produces a promycelium (Fig. 8). At about the middle of May the sorus becomes brighter yellow and the promycelia grow out. Each produces four small spherical sporidia, which become easily detached and are distributed by the wind. When the sporidia have been shed, the sorus loses its bright colour and shortly afterwards the diseased leaf falls. On coming into contact with the young needles of the spruce the sporidium produces a germ tube which bores through the epidermis and so brings about infection.

It frequently happens that certain spruces in a wood remain free from the disease, while others are badly attacked. This may be explained by the fact that infection of the young leaves only takes place at a certain stage in their development; trees which are in a backward condition when the sporidia are ripe are not infected, while at the same time others may have passed the susceptible stage and thus escape the disease.

As a result of the attack the infected leaves die and fall from the tree, and thus a considerable defoliation may take place. The disease, however, usually fails to maintain itself through a long series of years on any one tree, and in consequence felling is not desirable.

In the last issue of the *Quarterly Journal of Forestry* (ix., 1915, p. 253), which we have just received on going to press, Dr Somerville states that on April 21st specimens of spruce branches badly attacked by *Chrysomyxa abietis* were sent to him by Mr Neil MacGregor, Bridge of Dye, Banchory, Kincardineshire. The specimens were from trees about 20 years old which were planted under old larch and Scots pine, and were situated about 7 miles from the nearest part of the Durris woods, in which Dr Somerville discovered the disease in 1911.

We desire to thank Professor Trail and Mr. P. Leslie, M.A., B.Sc., who have kindly supplied information as to the distribution of *Chrysomyxa abietis*.

Explanation of Plate.

Figs. 1-5 refer to *Chrysomyxa Rhododendri;* Figs. 6-8 to *Chrysomyxa abietis*.

Chrysomyxa Rhododendri.

Fig. 1. Photograph of transverse section of leaf of *Rhododendron hirsutum* bearing teleuto-sorus. × about 126.
,, 2. Photograph of leaf of *Picea excelsa* bearing two aecidia. × 3.5.
,, 3. Part of pseudoperidium ; the upper cells are shown in surface view, the lower in optical section. × 480.
,, 4. Aecidiospore seen in surface view. × 960.
,, 5. Aecidiospore seen in optical section. × 960.

Chrysomyxa abietis.

Fig. 6. Photograph of leaves of *Picea excelsa* bearing teleuto-sori. × 3½.
,, 7. Photograph of transverse section of leaf of *Picea excelsa* bearing two teleuto-sori. × 57.
,, 8. Two teleutospores. × about 192.

32. The Great War.

THE SOCIETY'S ROLL OF HONOUR.

Names of Members, so far as known, who have joined the Colours.

Abercromby, Sir George William, Forglen, Turriff. Captain, 8th (Service) Black Watch, A.D.C. to General Sir Charles Fergusson, 2nd Army Corps.

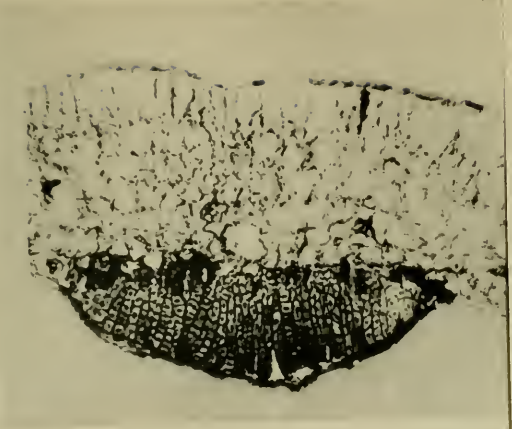
Adkin, B. C., Emmanuel College, Cambridge. 2nd Lieutenant, Army Service Corps.

Allison, Thomas, Solicitor and Factor, Fort William. Captain, 4th Cameron Highlanders (T.) (killed).

Baillie, Lieutenant-Colonel A. C., D.S.O., Factor, etc., Kirklands, Melrose. 2/2 Lovat Scouts.

Binning, The Lord, C.B., M.V.O., Mellerstain, Kelso. Colonel, 1/1 Lothians and Border Horse.

Black, Robert, 66 Queen Street, Edinburgh. Lieutenant, 2/5 Royal Scots.



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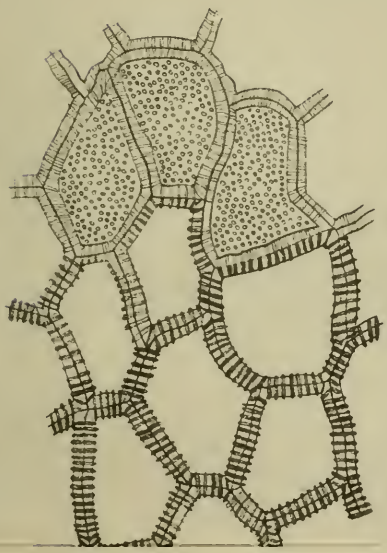

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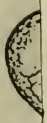

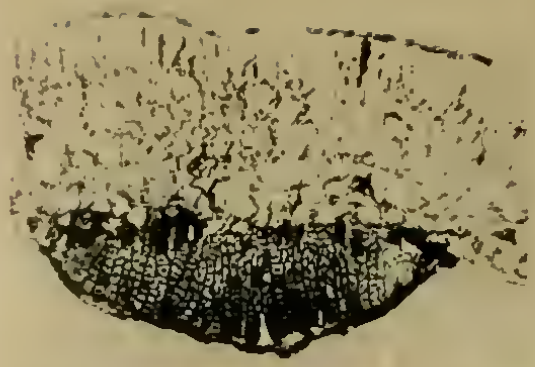

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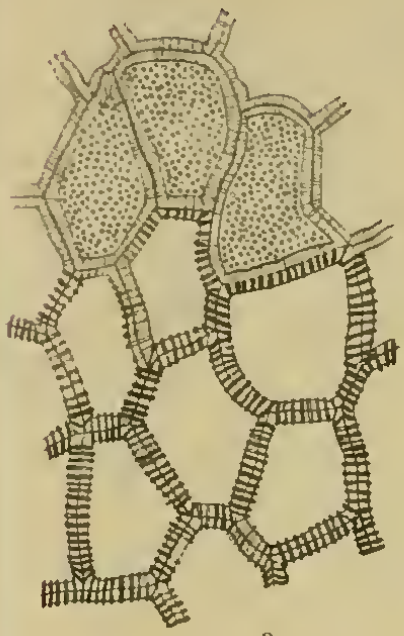

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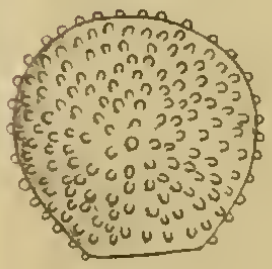

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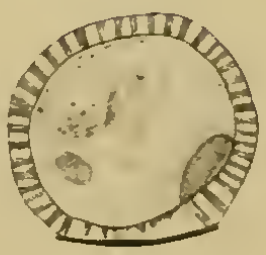

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1–5 Chrysomyxa Rhododendri 6–8 Ch. Abietis.

[To face p. 192

Borthwick, Henry, Borthwick Castle, Gorebridge. Lieutenant, 5th Scottish Rifles.

Brodie, Ian, of Brodie, Brodie Castle, Forres. Major, 2 Lovat Scouts.

Burnley-Campbell, Colin W., Ormidale, Colintrave. 2nd Lieutenant, 3rd (Res.) A. and S. Highlanders (killed).

Buttar, Fernie Louden, Forestry Student, 7 Linkfield, Musselburgh. Private, 9th Royal Scots.

Cadell, John Macfarlane, M.B., Lieutenant-Colonel, Indian Medical Service (Ret.), Foxhall, Kirkliston. Major, R.A.M.C., 10th (Res.) Royal Scots.

Cameron, Donald Walter, of Lochiel, Achnacarry, Spean Bridge. Colonel, 5th (Lochiel's) Cameron Highlanders.

Carruthers, Major Francis John, of Dormont, Lockerbie. King's Own Scottish Borderers.

Caverhill, W. R., Factor, The Glen, Innerleithen. S.Q.M.S. Lothians and Border Horse.

Christie, Thomas, Nurseryman, Rosefield Nurseries, Forres. 6th Seaforth Highlanders.

Clerk, Sir George James Robert, Bart., of Penicuik, Midlothian. Captain, Royal Scots Depot, Glencorse.

Clinton, The Lord, Fettercairn House, Fettercairn. Lieutenant-Colonel, 2nd Royal North Devon Hussars.

Cook, Melville Anderson, Assistant Forester, Glamis, Forfarshire. Sergeant, 5th Black Watch (T.).

Cowan, Henry Hargrave, Seafield Estates Office, Cullen. 2nd Lieutenant, 1st Highland Brigade, R.F.A. (T.).

Craig, Sir Archibald Gibson, Bart. of Riccarton, Currie (killed).

Crawford, The Earl of, Balcarres, Fife; 7 Audley Square, London, W. Private, R.A.M.C.

Dalhousie, The Earl of, Brechin Castle, Forfarshire. Lieutenant, 2nd Scots Guards (wounded).

Drummond, A. Hay, of Cromlix, Dunblane. Colonel, 6th Black Watch.

Duff, James, Forester, Balboughty, Perth. Army Service Corps.

Dunbar, John Christie Flockhart, Factor, Crathes Castle, Crathes. Captain, 7th Gordon Highlanders (wounded).

Ellice, Captain Edward Charles, of Invergarry. Grenadier Guards.

Faichney, John, Forester, Blythswood, Renfrew. Private, 6th A. and S. Highlanders.

FITZWILLIAM, The Earl of, Wentworth, Rotherham.

FLAHERTY, Ewen C., Assistant Forester, Royal Botanic Garden, Edinburgh. Private, 3rd Scottish General Hospital, R.A.M.C.

FLETCHER, J. Sydney, 13 Braidburn Terrace, Edinburgh. Private, Malay State Volunteer Rifles.

FOTHRINGHAM, W. Steuart, of Murthly, etc. Colonel, 2nd Scottish Horse.

FOWLER, Sir John Edward, Bart. of Braemore. Captain and Adjutant, 4th Seaforth Highlanders (T.) (killed).

FRASER, Alexander, Solicitor and Factor, *Hon. Secretary and Treasurer, Northern Branch*, 63 Church Street, Inverness. Colonel, 4th Cameron Highlanders (T.) (killed).

FRASER, James, B.Sc.(Agr.), Lecturer in Forestry, West of Scotland Agricultural College, Glasgow. Private, 14th A. and S. Highlanders.

FRASER, John Cameron, Assistant Forester, Innerbuist Cottage, Stormontfield, Perth. Scottish Horse.

FRASER-TYTLER, James Francis, of Woodhouselee, W.S., 22 Young Street, Edinburgh. Captain, 1 Lovat Scouts.

GILBERT, Alexander, Assistant Forester, Midhope Castle, Hopetoun, South Queensferry. Private, 15th Divisional Cycling Corps.

GRAHAM, James, Marquis of, Brodick Castle, Arran. Commander of the R.N. Volunteer Reserve, Clyde Division, and Competent Naval Authority for a part of the West of Scotland.

GRANT, Lieutenant-Colonel Arthur, D S.O., House of Monymusk, Aberdeen. 5th Gordon Highlanders (T.) (wounded).

GRANT, Donald, Forester, Fersit, Tulloch, Inverness-shire. Corporal, 4th Cameron Highlanders (killed).

GREIG, Robert Blyth (Hon.) M.Sc., LL.D., Member of Board of Agriculture, 29 St Andrew Square, Edinburgh. Captain, 15th (Service 1st Edinburgh) Royal Scots.

GRIFFITH, Sir Richard Waldie, of Hendersyde Park, Kelso. Lieutenant-Colonel, 2/4 King's Own Scottish Borderers.

GUTHRIE, Charles, Assistant Forester, The Biggins, Keir Estate, Dunblane. Private, 1st Scottish Horse.

HALL, Thomas, Superintendent of Public Park, 2 Vicarland Road, Cambuslang. Private, 6th Highland Light Infantry.

HAMILTON, The Lord, of Dalzell, K.T., C.V.O., Dalzell House, Motherwell. Captain, 1st Scots Guards.

Harrison, Alexander, C.A., 3 Napier Road, Edinburgh. Lieutenant, 7th Royal Scots.

Hay, Malcolm V., of Seaton, Seaton House, Aberdeen. Captain, 1st Gordon Highlanders (prisoner).

Hinckes, Ralph T., of Foxley, Hereford. Captain, 1/2 Herefordshire Regiment.

Hopkinson, Andrew Douglas, B.Sc.(Agr.), Lecturer in Forestry, Royal Agricultural College, Cirencester. 2nd Lieutenant, 4th Gordon Highlanders (wounded).

Hopkinson, James Garland, Factor, Drumtochty Estates Office, 11A Dee Street, Aberdeen. Captain, 4th Gordon Highlanders.

Howard de Walden, Baron, The Dean, Kilmarnock. Major, Westminster Dragoons.

Innes, Alexander B., of Raemoir and Dunnottar, Raemoir House, Banchory. Lieutenant, 7th Gordon Highlanders (killed).

Irvine, Alexander Forbes, J.P., B.A.(Oxon.), Drum Castle, Aberdeen. Corporal, 20th Royal Fusiliers.

Jack, David, Assistant Forester, The Park, Guildtown, Perthshire. Private, 3rd Black Watch.

Kinnaird, The Master of, 10 St James Square, London (killed).

Lamington, The Lord, G.C.M.G., Lamington. Lieutenant-Colonel, Lanarkshire Yeomanry.

Leather, Major Gerard F. T., Middleton Hall, Belford, Northumberland. 1/5 Northumberland Fusiliers.

Leschallas, Major John Henry Pigé, Glenfinart, Ardentinny. 4th A. and S. Highlanders.

Leslie, Archibald Stewart, W.S., 33 Queen Street, Edinburgh. Major, 2nd Scottish Horse.

Linlithgow, The Marquess of, Hopetoun House, South Queensferry. Lieutenant, Lothians and Border Horse.

Logan, Rev. Innes, M.A., United Free Manse, Braemar. Chaplain, 4th Class (Captain) R.F.A.

Lovat, The Lord, K.T., C.B., D.S.O., Beaufort Castle, Beauly. Brigadier-General, Highland Mounted Brigade.

Luke, Nicol, Forester, Cairndow, *via* Inveraray. Corporal, 8th A. and S. Highlanders.

Macalpine-Leny, Major R. L., of Dalswinton. 16th Lancers.

M'Callum, D., Assistant Forester, The Groan Cottages, Logiealmond, Perth. Highland Cycle Battalion.

Macdonald, Arthur J., Assistant Forester, Stormontfield Road, Scone. Highland Cycle Battalion.

MacDonald, Donald R., Assistant Forester, Pitcairngreen, Almondbank, by Perth. Lovat Scouts.

Macdonald, The Hon. Godfrey Evan Hugh, Factor, Macdonald Estates Office, Skye. Scots Guards (killed).

Macdonald, John Ronald M., of Largie, M.A., D.L., J.P., Largie Castle, Tayinloan, Kintyre. Red Cross Orderly in a French Military Hospital.

M'Ewan, W., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth. Scottish Horse.

Mackenzie, Lieutenant-Colonel A. F., of Ord, Ord House, Muir of Ord. 10th A. and S. Highlanders.

Mackenzie, Evan North Barton, Kilcoy Castle, Killearnan. Captain, Lovat Scouts.

Mackenzie, Nigel Blair, Factor, Fort William. Captain, 4th Cameron Highlanders (wounded).

M'Lean, James Smith, Forester, Douglas Castle, Lanarkshire. Lance-Corporal, 4th Scottish Rifles.

MacRae-Gilstrap, John, of Ballimore. Lieutenant-Colonel, 11th (Service) Royal Highlanders (Black Watch).

Maxwell, Aymer, Yr. of Monreith, Port William, Wigtownshire. Lieutenant-Colonel, Collingwood Battalion, First Brigade, Royal Naval Division (killed).

Maxwell, Wellwood, of Kirkennan. Major, 3/5 King's Own Scottish Borderers.

Milne-Home, David William, of Wedderburn, Caldra, Duns. Lieutenant-Colonel, Royal Garrison Artillery.

Minto, The Right Hon. The Earl of, Minto House, Hawick. Lieutenant, Scots Guards.

Moncreiffe, Sir R. D., Bart. of Moncreiffe. Colonel, 6th Black Watch.

Morgan, John, Assistant Forester, The Dean, Kilmarnock. Corporal, 7th Royal Scots Fusiliers.

Mowat, William, Assistant Forester, Innerbuist Cottage, Stormontfield, Perth. Scottish Horse.

Murray, William, of Murraythwaite, Ecclefechan, Dumfriesshire.

Nelson, John Ross, Assistant Forester, North Stables, Kelburn, Fairlie. Private, 4th Cameron Highlanders.

Nelson, Thomas Arthur, of Achnacloich. Lieutenant, Lothians and Border Horse.

Norris, Henry, E. Du C., Agent Basildon Park, Reading. Major, Royal Naval Division.

PLUMMER, C. H. Scott, of Sunderland Hall. Major, 2/1 Lothians and Border Horse.

PRINGLE, James Lewis, of Torwoodlee, J.P., D.L., B.A., Torwoodlee, Galashiels. Captain, Lothians and Border Horse.

RALSTON, Claude, Factor, Estates Office, Glamis. Captain, 5th Black Watch.

REID, Alexander, T., Milldeans, Star, Markinch. Lance-Corporal, 7th Seaforth Highlanders.

REID, James, jun., Probationer, Royal Botanic Garden, Edinburgh. Private, 5th (Lochiel's) Cameron Highlanders.

REID, Robert Matelé, Thomanean, Milnathort. Captain, 3/7 A. and S. Highlanders.

RITCHIE, Charles Ronald, W.S., 37 Royal Terrace, Edinburgh. Lieutenant, Lowland Mounted Brigade, A.S.C.

ROBERTSON, Andrew, Assistant Forester, Dean Road, Kilmarnock. Private, 7th Seaforth Highlanders.

ROBERTSON, George, Foreman Forester, Budby, Ollerton, Newark, Notts. Private, 1st Sherwood Foresters.

ROSSE, The Earl of, Birr Castle, Birr. Major, 1st Irish Guards (wounded).

ROXBURGHE, The Duke of, K.T., M.V.O., Floors Castle, Kelso. Lieutenant, Royal Horse Guards (The Blues) (wounded).

SCOTT, John A., Forester, The Gardens, Knockbrex, Kirkcudbright. Private, 6th (Service) King's Own Scottish Borderers.

SCOTT, Andrew, Assistant Forester, Keir. Private, 6th Black Watch.

SPIERS, Thomson B., Assistant in Timber Yard, 4 Warriston Crescent, Edinburgh. Lothians and Border Horse.

SPROT, Captain Mark, of Riddell, Adjutant, 2/1 Lothians and Border Horse.

STAIR, The Earl of, Lochinch, Castle Kennedy. Captain, Scots Guards (prisoner in Germany).

STARK, Thomas, Head Forester, Holker, Cark-in-Cartmel, Lancs. Private, 5th King's Own Royal Lancashire Regiment (T.).

STEWART, William, of Shambellie, Kirkcudbrightshire. Captain, 10th Black Watch.

STIRLING, Archibald, of Keir, *President.* Colonel, 2 Lovat Scouts.

STIRLING, Thomas Willing, of Muiravonside. Lieutenant-Commander, The Admiralty.

STRATHARN, Tom Dalrymple, Land Agent, P.A.S.I., Grimeshill. Inns of Court O.T.C.

STUART, Lord Ninian Edward Crichton, M.P., House of Falkland, Fife. Lieutenant-Colonel, 6th The Welsh Regiment.

SUTHERLAND, The Duke of, Dunrobin Castle, Golspie. Serving with the British Mission to the Belgian army.

TAIT, James, Westshiel, Penicuik. Captain, 8th Royal Scots.

THREIPLAND, Lieutenant-Colonel W. Murray, Dryburgh Abbey, St Boswells.

TIBBLE, Ernest Frank, Assistant Forester, Bridgend, Inverkip. 195th Company A.S.C.

TULLIBARDINE, The Marquis of, D.S.O., Blair Castle, Blair Atholl. Brigadier-General, Scottish Horse Brigade.

VESCI, The Viscount de, D.L., Abbeyleix, Ireland. Captain, Irish Guards.

WADDINGHAM, James Hart, Elsham, Grimsby. Bombardier, 2nd Lincolnshire Royal Field Artillery.

WALKER, Austine Harrington, Chemical Manufacturer, Richmond House, Dullatur, Dumbartonshire. Lance-Corporal, 9th H.L.I. (1st Glasgow Highlanders).

WARING, Captain Walter, M.P., of Lennel, Coldstream. Major, 1st Lothians and Border Horse.

WATT, William, Assistant Forester, Redstone, Darnaway. Lance-Corporal, 2/1 Scottish Horse.

WHIPPEY, Alan Cecil, Assistant Forester, 11 Lindfield Road, Ealing, W. Private, Royal Berks Regiment (T.).

WILSON, Adam Frank, C.D.A.(Edin.), 164 Braid Road, Edinburgh. Lieutenant, A.S.C., Scottish Horse Brigade.

WILSON, Andrew Robertson, M.A., M.D., Hopewell, Tarland, Aboyne; and Cairnmore, Liscard, Cheshire. Lieutenant-Colonel, R.A.M.C. Commanding 1/3 Welsh Field Ambulance.

The List will be continued in the January *Transactions*, and the Secretary will therefore be glad to receive additional names of members serving, with particulars of their rank, battalion, regiment, etc. Corrections on the above List should also be intimated to the Secretary.

33. Fourth Report of the Development Commissioners for the year ending 31st March 1914.

The following extracts are taken from the above report as being of special interest to Scottish foresters :—

"Fourteen applications falling mainly or entirely under the heads of forestry and afforestation were received during the year 1913–14. The total of the advances for which application was made amounted to £221,000. The Commissioners recommended advances of £91,114 in all.

"The measures which can be taken by the State to promote forestry and afforestation fall obviously into two main divisions; first, provision for improved education, research, and technical advice; and, secondly, afforestation by the State itself, or the giving of pecuniary assistance by the State to other bodies desirous of afforesting land. These two lines of work cannot be dissociated from one another; forestry education, for instance, implies in this country a certain amount of actual afforestation work, both for the practical part of teaching and as a demonstration of the lines on which local authorities and private owners should proceed; afforestation on any considerable scale requires a trained staff of foresters and woodmen, which is scarcely yet available here in any numbers.

"Under the first head (education, research, etc.) the Development Fund already supports a scheme to provide instruction and advice at five centres in England and Wales (Oxford, Cambridge, Cirencester, Bangor, and Newcastle) and provides also for research work and minor experiments. During the year this scheme has been supplemented by the completion of arrangements for the utilisation of Dean Forest and the adjoining woodlands as a demonstration area, at an estimated cost to the Fund of £13,700 for capital expenditure, and £1700 for maintenance. In Scotland, considerable provision was made during 1912–13 for higher forestry instruction at Edinburgh University, by a grant to cover a period of five years. During the past year the financial and other questions relating to the appointment of advisory officers have at length been settled, and the Commissioners have agreed to an advance of £1500 for the salaries and expenses of advisory officers to be attached to the three centres of education at Aberdeen, Edinburgh and Glasgow.

The main outstanding requirement of a Scotch demonstration area has received much attention from the Commissioners, who were not altogether satisfied with the scheme put before them by the Scottish authorities. They are aware of the importance of this question, and hope that a scheme may shortly be submitted which can be accepted by all parties concerned. In Ireland where there is little likelihood of private enterprise in this direction, it has been thought best to devote to State afforestation the funds available.

"As regards afforestation, the Commissioners pointed out last year that the amount of the Development Fund, in relation to the claims upon it, does not permit the Commissioners to contemplate afforestation upon any large scale, unless it is possible to draw also upon other funds. 'Excluding the purchase of land, it may be taken that £10 per acre is the minimum expenditure usually required before the planting operations begin to produce returns. As the total amount guaranteed to the Development Fund is £2,900,000 for numerous purposes, of which forestry is only one, it will be clear that the afforestation of even 100,000 acres solely from that Fund is scarcely feasible unless its resources are considerably augmented.' For this reason, two main lines of action were proposed; to assist the purchase and planting of experimental and demonstration areas of, perhaps, 5000 acres, in different districts in England and Wales, and to make loans to local authorities already possessing suitable land. The Commissioners are consulting with the Board of Agriculture and Fisheries on a scheme for acquiring the first experimental area, and they have during the past year succeeded in settling the difficult questions arising out of the most important application for a loan to afforest land which has been made by a local authority. A loan of £25,000 to the Liverpool City Corporation has been recommended, for the afforestation of a large part of its water-catchment area at Lake Vyrnwy. The Commissioners hope that now that the first advance of this kind has been settled (it is always the first case of a new problem which causes trouble and delay), it will serve as a precedent for other great municipalities. In Scotland the Commissioners are conferring with the Board of Agriculture on the question whether arrangements can be made to lease land for afforestation from private landowners, on the basis of a division of the ultimate proceeds; they have been

advised that loans cannot legally be made from the Development Fund to individual estate-owners to encourage them to place their land under timber. In Ireland they have consented to raise to £40,000 the total sum set aside for the purchase of land for afforestation, and have agreed in principle with the Department of Agriculture and Technical Instruction on a policy of concentration on areas of not less than 5000 acres. About 9000 acres in Ireland have been purchased, and the working-plan has been settled for the first of the areas to be afforested (Ballyhoura in County Cork), and the first instalment paid of a total advance of £31,430 for planting and maintenance. Communications are proceeding for the settlement of the working-plans of two other areas."

Scotland.—"Provision was made for higher Forestry Education in 1911-12 by a grant of £11,000 (to cover a period of five years) to Edinburgh University, for the joint benefit of students at the University and at the East of Scotland College of Agriculture. During the past year a further step has been taken. A settlement has been reached of the differences (mainly on financial questions) between the Commissioners and the Board of Agriculture for Scotland in regard to the Board's application for a grant for the appointment of forestry officers for advisory, survey and research work, and the Commissioners have recommended a grant of £1500 for the salaries and expenses of three such officers during 1914-15.

"Towards the end of the year the Commissioners received an application from the University of Aberdeen for advances of £2500 to pay the salaries of a permanent assistant to the present lecturer, and of an additional lecturer for five years, £2000 for the equipment of a forestry museum and laboratories, and a further sum (from £4000 to £7500) for the building of a forestry class-room, museum and laboratories; they could not, however, see their way to recommend advances on the scale desired, and have asked the University to submit a revised and reduced scheme.

"They think that the provision already made for forestry education at Edinburgh (together with further provision to be made at Aberdeen) and the appointment of the three forestry officers will go a great way towards meeting immediate requirements; but they have always been of opinion that, in addition, a demonstration area should, if possible, be provided for Scottish

forestry students, as for English. During the past year this subject has received much attention from the Commissioners. Two estates (one in Aberdeenshire and one in Kincardineshire) were brought to their notice as worthy of consideration for the purposes of a national demonstration area; but the Commissioners were advised that neither of them is suitable. The Board of Agriculture, however, were disposed to think that the Aberdeenshire estate would be satisfactory, and made provisional application in December last for an advance of £100,000 to meet expenditure on its purchase and equipment.

"On the whole question the Commissioners have heard the views of the University of Edinburgh, and have conferred repeatedly with representatives of the Board of Agriculture for Scotland and of the Scottish Advisory Committee on Forestry. They are now endeavouring to frame a scheme which would render available for forestry demonstration and instruction a large area near the geographical centre of Scotland; and sincerely hope that that scheme, if it can be reduced to a definite and practical shape, will be accepted by all concerned as a reasonable solution of a difficult problem.

"They have been in communication during the year with the Board of Agriculture for Scotland on another question of importance, viz., the afforestation of privately owned lands. As soon as the 'test case' of the afforestation of the Liverpool water-catchment area at Lake Vrynwy is settled[1] they hope to enter into communication with one or two of the Scotch municipalities in regard to similar schemes; the Dundee area at Lintrathen in Forfarshire was inspected some time ago and parts of it were reported to be suitable. But they have been advised that advances cannot legally be made from the Development Fund to private individuals to assist them in afforesting their

[1] "Last year the Commissioners gave the terms of a statement which they had issued for the guidance of local authorities who might contemplate applying for State aid in carrying out schemes of afforestation on areas under their control, and mentioned that they had received communications on the subject from several of the great municipalities. With one of these municipalities, viz. Liverpool, negotiations were well advanced at the commencement of 1913–14, and the Commissioners thought it best to concentrate on the settlement of that scheme, in order that it might serve as a guide for others. The first application of a novel character is bound to raise questions which require time and care; but when they have been settled in one case, the principles on which that case has been decided can more easily be adapted to other schemes of a like character."

land ; and the Commissioners have, therefore, been compelled to consider an alternative plan, under which land could be leased by a suitable executive authority from the owner, and afforested with assistance from the Development Fund. The question of the authority to work out and execute such schemes (the Commissioners themselves having no executive power) now requires a solution, which they hope will be found shortly. They trust that in the event of this obstacle being overcome, private landowners will be willing to share the financial burden and risk of afforesting their land, by letting it on what may be called a proceed-sharing lease instead of payment of a fixed rent from the beginning of the lease. It is clear that if a landowner himself starts afforesting his land, he loses for many years any grazing rent which he has previously received for the part afforested. The object of a proceed-sharing arrangement is to defer payment for the use of the land till the proceeds of the afforestation accrue, and thereby set free for actual afforestation that part of the limited resources of the Fund which would otherwise have to be devoted not to planting but to the acquisition of land preliminary to planting. It is possible also by lease to select only land suitable for afforestation, whereas a purchase scheme must almost always include land more fitted for agricultural or other purposes.

"One minor matter may be mentioned in conclusion. The Distress Committee of the City of Glasgow applied for a grant of £640 for the afforestation of about 80 acres of their estate at Palacerigg. After an inspection of the area by one of the Commissioners, they came to the conclusion that the site does not lend itself to a practical scheme of afforestation. The Distress Committee have since submitted another scheme, which was being considered at the close of the year, for the reclamation and development of parts of the Palacerigg estate by means of shelter belts."

NOTES AND QUERIES.

Appointment for Hon. Editor.

(*With Portrait.*)

The members of the Royal Scottish Arboricultural Society will learn with interest that the Hon. Editor of the *Transactions*, Dr A. W. Borthwick, has been appointed by the Board of Agriculture for Scotland, with the approval of the Secretary for Scotland and H.M. Treasury, to be their Advisory Officer for Forestry in succession to the late Dr John Nisbet.

Dr Borthwick, who has acted as Hon. Editor since the death of Col. Bailey at the end of 1912, was educated at the Madras College, St Andrews, and the University of St Andrews, where he took high places in botany and mathematics and obtained the degree of B.Sc. Subsequently he proceeded to Bavaria, where he remained for three years, and passed with distinction through a complete theoretical and practical course of forestry. On his return to this country he was appointed in 1899 assistant to the Professor of Botany and Lecturer in Plant Physiology in the University of Edinburgh, an appointment which he held until, in 1908, he took up the post of Lecturer in Forest Botany. In 1904 he obtained the degree of D.Sc., and in 1905 was appointed Lecturer in Forestry in the East of Scotland College of Agriculture. During his long period of work at the Royal Botanic Garden as assistant to the Professor and Lecturer in Forestry and Forest Botany there, Dr Borthwick devoted himself especially to those aspects of botany which have a bearing upon forestry, and most of the numerous special pieces of research which he undertook were concerned with problems connected with the normal and abnormal growth of trees.

During the period of his residence in Edinburgh Dr Borthwick has taken a conspicuous part in the work of the scientific societies dealing with the various aspects of botany and forestry, and, as the members know, has been especially active as a member of the Council of this Society. Since 1903 he has been Hon. Consulting Cryptogamist, and in 1909 he acted as guide in the Society's excursion to the forests of Bavaria. His contributions to the *Transactions* have been numerous, and his work as judge of exhibits at the Society's exhibitions and in connection with the competitions for Estate Nurseries and

A. W. BORTHWICK, D.Sc.

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Plantations has always been very highly appreciated. He has also been frequently consulted by proprietors of forestry estates in regard to the management of their plantations, and in this way has acquired a wide knowledge of the conditions under which successful silvicultural operations can be carried out in Scotland. His new appointment should greatly promote the cause of forestry in the country. R. G.

Excursion, Exhibition, and Nursery and Plantation Competitions.

The Council, after careful consideration of all the circumstances, came to the conclusion that it would be advisable to abandon the excursion this year. The directors of the Highland and Agricultural Society having also decided to postpone their show, this necessarily implied the postponement of this Society's annual exhibition of forestry. The competitions for estate nurseries and plantations, while not so dependent as the exhibition on the show, were closely identified with it, as the competitions were always confined to the area of the show, and the Council accordingly decided that they also should be postponed, so as to keep them in the same rotation with the show and the exhibition.

The Council regret very much this temporary interruption of part of the Society's work owing to the war, and they hope that those who had been making preparations for this year will reserve them for the future.

Japanese Larch.

I have read some interesting reports in your *Transactions* on the growth of Japanese larch as compared with British, but I have not seen any discussion on the merits of the two timbers compared. I now beg to forward you some figures which I think may be of interest to some of your readers, and I enclose copy of report made to me by one of the biggest iron mines in Cumberland. These tests were carried out with common and Japanese larch 13 years old, grown on the same ground, and I think you will agree with me that there is no comparison whatever between the two timbers. The tests, which

were carried out on the two species of larch were identical with the tests to which all timber used by the mine is subjected, and I can vouch for the accuracy of the figures, which may, I think, be looked on as conclusive as to the inadvisability of planting Japanese larch on a big scale commercially. As an ornamental tree I have not a word to say against the species, in fact it will out-grow the common larch by inches in a year. Please note that I do not wish to put forward my views as to the Japanese larch, but simply to state facts. I myself have been a planter for some years in this country and in the East, and my father and grandfather and many of my relations have been planters in this country on fairly extensive lines for a great many years.

"*Report on the comparative strength and durability of* 13-*year-old Japanese and European larch carried out by the timber tester at Hodbarrow mine, Cumberland, at the pit head, 24th May* 1915.

"The pieces of larch were each placed on supports 4 ft. 6 ins. apart, and subjected to gradual pressure at the centre by means of a screw, having a pitch of half an inch, turned by four men at the end of a lever—

Test No. 1.—Japanese larch, 6 × 5 ins.
Broke at $2\frac{1}{4}$ turns = 1 deflection.

Test No. 2.—English larch, 6 × 5 ins.
Broke at $4\frac{1}{2}$ turns = $2\frac{1}{4}$ deflections.

Test No. 3.—Japanese larch, $7\frac{1}{4}$ ins. diameter over bark.
Cracked at 6 turns = 3 deflections.
Broke at 8 turns = 4 ,,

Test No. 4.—English larch, $7\frac{1}{4}$ ins. diameter over bark.
Cracked at 14 turns = 7 deflections.
Broke at $15\frac{1}{2}$ turns = $7\frac{3}{4}$,,

Test No 5.—Japanese larch, $8\frac{3}{4}$ ins. diameter over bark.
Cracked at 6 turns = 3 deflections.
Broke at 7 turns = $3\frac{1}{2}$,,

Test No. 6.—English larch, $8\frac{1}{4}$ ins. diameter over bark.
Cracked at 12 turns = 6 deflections.
Broke at 16 turns = 8 ,,

"In all the above tests the nature of the fracture was greatly in favour of the European larch, the Japanese larch broke

Sitka Spruce at Mount Melville, St Andrews.

Douglas Fir at Mount Melville, St Andrews.

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Fig. 1. Loading the Timber Trolley.

Fig. 2. The Trolley Loaded.

shorter and did not show the toughness of fibre exhibited by the European larch."

I vouch for the accuracy and *bona fides* of these measurements.

James Marshall,
Mount Coniston.

Sitka Spruce and Douglas Fir at Mount Melville.

(*With Plate.*)

I am sending you two photographs (Plate XXII.), one of Douglas fir and one of Sitka spruce growing on the estate of Mount Melville, St Andrews. Planted in the spring of 1911 as 2-year 1-year they were inserted by the notch system, and have, I think, done remarkably well. Last year's growths have in many instances reached 4½ feet, and not a few of the young trees of both sorts are over 10 feet high.

There are about 2 acres—adjoining—in each section, both of which, as regards soil, situation, etc., are in exactly similar conditions. The plantation is about 300 feet above sea-level, on sloping ground facing south and south-east, and fairly well sheltered. The soil for most part is rather shallow and rests on boulder clay.

Wm. Gilchrist.

Timber Removing.

(*With Plate.*)

The removal of timber from awkward places in the forest and policies is very often a difficult operation, and one which calls for great care and consideration on the part of the forester or timber merchant. The method of transport adopted, while involving the smallest possible outlay, should be such that the minimum amount of damage is likely to be done to the roads, walks and grass of the policies.

The writer has had five years of forestry experience in England, and has during this time used with success a small trolley or bogey. The trolley consists of two low, broad wheels upon which rests a bolster with a pole attached. When the trolley is loaded, the root end of the tree to be removed rests on the bolster, while the small end trails lightly on the ground behind.

For the purpose of loading, a runner is placed in position and attached to hooks on the bolster.

A horse is used to draw the tree-trunk on to the trolley. For this purpose a chain, attached to the neck of the trolley-pole, is slipped under the log, brought round and finally fastened to the hook of the swing-tree (see Plate XXIII. Fig. 1); the horse then draws the log into position. The chain is now unhooked from the swing-tree and hitched round the log towards the small end. When the horse, which is next yoked to the trolley, begins to draw, the chain tightens round the log without any racking (Fig. 2).

The writer has used the trolley most successfully at Poltalloch, and several timber merchants here and elsewhere have adopted the device with equally successful results. Those used by the writer in England were well finished by an expert cartwright, and cost £10 each; but they can be made in rougher fashion for half this sum, as is the case with those in use here. The following are the part measurements of the trolley:—

1.	Breadth of wheel tyres, made up of two 6-inch wide rings	12 inches.
2.	The wheels, made of three 4-inch planks, are bolted together, so that the centre of the 6-inch tyre crosses the joint. The writer has substituted round blocks of wood. Diameter of wheel . . .	18½ inches.
3.	Bolster between wheels (length) . .	23 ,,
4.	Bolster on top	42 ,,
5.	Depth of bolster between wheels . .	16 ,,
6.	Length of pole inserted through bolster including ring at point end . . .	72 ,,
7.	Length of square frame on which the pole lies. The writer has substituted different bolster arrangement	42 ,,
8.	Length of pole for loading, including two hooks which drop into staples on each side of bolster end above wheel . .	60 ,,

The breadth of the wheels prevents the breaking-up of ground or grass surface, while since it is low of build the trolley is easily loaded and unloaded. As the root-end of the tree is loaded on the bolster the load is a great deal easier for the horse

to draw than it would be otherwise. The expense in removing timber, where the trolley can be suitably worked, is greatly reduced, thereby increasing the value of the timber.

ALEXANDER MACPHERSON.

CUCURBITARIA PITHYOPHILA, Fries.

In May 1907 I found a parasitic fungus on stems and branches of living Scots pine in a plantation near Inver (Torvald Wood) on the Dunkeld estates. Mr Carleton Rae, of Worcester, to whom specimens were sent for identification, named it *Cucurbitaria pithyophila*, Fries., but could not at the time tell whether it was British or not. Tubeuf and Smith mention this fungus as occurring on the living branches of various conifers, *e.g. Pinus Cembra*, but do not say that it had been found in Britain.[1]

Since 1907 the fungus has also been found in the neighbouring plantation of Ladywell.

The trees in Torvald Wood vary from 30 to 40 years of age, while those in Ladywell Plantation are somewhat older. Both plantations are said to have been made with plants raised from foreign seed, and this is not unlikely, as the trees assume a spruce-like appearance which is not common in the other trees in the locality.

The parasite can be seen with the naked eye, and appears as minute, black, globose bodies, closely clustered together in patches 1 to 3 inches long and nearly as much broad. Sometimes it forms a ring right round the stem or branch; in other cases it forms a patch at one side. When a stem or branch is ringed by the parasite it soon dies. In the case of the stem a new leader may be formed ultimately, or in many cases a fascicle of twigs, resembling the "Witch's Broom" which occur on many trees, is produced. When the parasite is confined to one side of the stem or branch, swellings and contortions are produced, and the wood becomes flooded with resin. Indeed, the effects produced resemble those arising from *Peridermium pini corticola* (Cronartium sp.).

Where the parasite has been present the parts attacked have a blackened and scorched appearance. This scorched appearance,

[1] Tubeuf and Smith, *Diseases of Plants induced by Cryptogamic Parasites*, 1897.

together with the fasciculated and abnormal branching of many trees point to the presence of the parasite even although the fruits (perithecia) may not be found.

The Torvald Wood has just been heavily thinned for pitwood, and I find a large proportion of the trees are affected in the manner indicated, and on many the fruits of the parasite are to be found.

It might be well for foresters to keep on the outlook for this disease, since it is possible that some of the damage formerly attributed to the ordinary pine blister (*Peridermium pini corticola*) may be due to this *Cucurbitaria pithyophila*.

CHARLES M'INTOSH.

TIMBER GROWING FOR PROFIT.

If all landowners went in for timber growing with the same method and enthusiasm as they give to the raising of agricultural crops, there is no reason why it should not become equally if not more profitable. The great trouble is, they do not or will not regard trees as a crop, but rather look upon them as useful or ornamental objects. The rule is to go into the wood and cut down the tree most suitable for the purpose in hand regardless of the effect that the removal of the said tree may have on its neighbours. This is a big question and would require a lengthy article itself.

On this estate a piece of waste land of about 100 acres was taken in hand in the year 1907, for the purpose of forming a plantation. The ground was formerly covered with a mass of heather, rough grasses and rushes with a few scraggy old conifers. The old trees were cut and removed, heather and grass burnt over, the whole area drained and fenced, and 3 feet wire-netting erected. In the spring a quantity of 2-year 2-year Scots pine was purchased from a public nursery and planted out. These proved a failure. In the autumn of that year an estate nursery was made and stocked with 2-year seedlings of the various kinds of conifers. A fresh start was made with the planting of the area in question by putting in four rows of trees as a wind-break all round the margin, in the following order:— First row larch, second row sycamore, third row larch, fourth row beech. The altitude runs from 600 feet above sea-level at the lowest point, up to 950 feet at the top of the ridge, and has a

north-west aspect. The plants used were 2-year 2-year Scots pine with a slight mixture of birch on the higher ground, and on the lower reaches Norway spruce, Sitka spruce, and a few Douglas fir. The plants were all notch-planted, and those put in in the spring have done best on the whole. Black game were pretty severe on the Scots pine at first, but after using a mixture of archangel tar and tallow, this trouble was got over. The trees that were disbudded took on rather a bushy appearance, but in the course of the fourth and fifth years they regained their normal shape. A judicious use of the pruning knife at this stage was a great help to them in this direction.

Sitka spruce was rather troublesome at first owing to its leading shoot being nipped back by the early frosts, but once it got about 3 feet above the ground line it quite left the common spruce behind. Douglas fir has not done so well. This area was fully stocked in the spring of the present year, and is now doing well. Very little beating up was necessary after using the home nursery plants, and the whole operation cost about £7, 10s. per acre. The notch system of planting was the only practical one in the circumstances, and it answered quite well.

GEO. MOWAT.

EMPLOYMENT IN FORESTRY FOR WOMEN AND DISABLED SOLDIERS.

The Council has issued the following circular, copies of which may be obtained on application to the Secretary:—

"A committee of the Council has for some time been co-operating with the Scottish Committee on Women's Employment in securing employment for women whose ordinary occupations have been interfered with by the war, and already a considerable number of women have been suitably placed on estates in various districts throughout the country. Encouraged by the success which has so far attended the committee's efforts, the Council has now decided that the committee should also try to find light work for soldiers who, owing to partial disablement, are unable to undertake work of a heavy nature. The work which men who have lost an arm or a leg could do would naturally be somewhat limited in variety, but many other kinds of partial disablement would not present such difficulties, and there are many forms of light

work associated with forestry which can be quite efficiently done by women and partially disabled men, such as the following:—

1. Bracken cutting and switching on land to be cleared for planting.
2. Planting, or carrying plants to planter.
3. Cleaning young plantations, *e.g.* cutting out rank weed growth or weed tree species.
4. Gathering and burning brushwood on felling areas.
5. Cutting and bundling birch twigs.
6. Cutting and bundling hazel rods.
7. Cutting, bundling, and peeling willows.
8. Seed collection.
9. Barking and stacking pit props.
10. Nursery work.
    - (*a*) Seed cleaning and preparation for sowing.
    - (*b*) Weeding and hoeing.
    - (*c*) Lining out.
    - (*d*) Lifting and sizing plants.

"In addition to the above, other departments of estate work of a light nature would be suitable, and, under present circumstances, might otherwise be neglected, such as the keeping in order of drives, walks, paths, borders, lawns, parks, and policies. There should also be suitable work in the gardens of places with small or depleted staffs.

"The Committee would be glad to have your co-operation in the matter, and to know whether you would be willing to take any workers—men or women—and how many, if they were available, and suitable terms could be arranged; also whether any of the estates in your district would be willing to help in this way."

Afforestation, and Soldiers and Sailors returning at the End of the War.

The following resolution was passed at the meeting of the Society, held on Wednesday, 14th July 1915:—

"The Royal Scottish Arboricultural Society, in General Meeting assembled, while recognising that the first duty of the Nation at this time is to do everything in its power to bring the war to a speedy and successful termination, respectfully points

out that at the end of the war a large number of soldiers and sailors who return may not be able to resume their former occupations and may desire to find outdoor employment and a comfortable home in the country, which, under present circumstances, they would not be able to do, and that Afforestation—with which might be advantageously combined Small Holdings and other Rural Industries — if carried out on a considerable scale in various centres, would afford suitable employment, under healthy conditions, for a large and ever-increasing rural population. The Society therefore, without repeating the now familiar arguments in favour of Afforestation, all of which have been greatly strengthened by events since the war began, respectfully draws the attention of the Government to the urgent need of immediate preparation for the emergency referred to, and suggests that the Board of Agriculture for Scotland, as the body charged with the care of Forestry in this country, should be authorised to prepare schemes of Afforestation on the lines indicated, and should be assured that adequate funds will be provided to put those schemes into operation whenever the war is over, so as to meet the needs of returning soldiers and sailors and others who desire to settle upon the land."

REVIEWS AND NOTICES OF BOOKS.

Chinese Forest Trees and Timber Supply. By NORMAN SHAW, B.A. 351 pp. with a map and 33 illustrations. Price 10s. 6d. net. London and Leipsic: T. Fisher Unwin.

This book is a useful compilation of facts derived from correspondence or conversation with missionaries and others, and from a large number of books and articles, of which a comprehensive list is given. As a great part of China is still unexplored by the foreigner, accurate information regarding the state of its forest resources is not available, but on every side there is evidence of centuries of neglect, waste and actual devastation. Manchuria in the north contains large tracts of valuable forests, and several provinces in the south-west have a considerable trade in home timber, but upon the whole China imports one-third of the amount of her timber consumption. In a section devoted to "The Forest Problem," the writer describes the steps that have

been taken in countries such as France, India, the Philippine Islands and Japan to deal with their problem, and indicates how the example of these countries might to some extent be applied to Chinese conditions. There is evidence, however, that the Government of China has at last awakened to the importance of the forestry problem. A Department of Agriculture and Commerce, which includes a Bureau of Agriculture and Forestry, has been established; a School of Agriculture and Forestry has been instituted at Pekin, and a course in forestry is given in a number of agricultural colleges. At Moukden, the capital of Manchuria, a forest school has been in existence since 1907, and the Government has set aside about 25,000 acres for forest-planting in that province. Following the Government's example, various private owners, and mining and railway companies, have also made some progress with the planting of the lands belonging to them. In addition to other matter, the book contains a general description of the forests in each province, notes on Chinese forest trees, appendices regarding rafts and rafting, and notes on the timbers used by the railways, an index of place names, and a general index.

Pocket Register of Woods and Plantations. By James W. Mackay. Published by The County Gentleman's Association, Ltd.

This little book is of a convenient size for the pocket, and in it columns and spaces are provided whereby notes can be readily jotted down, on the spot, concerning the methods of planting, rate of growth, fencing, etc., together with the cost of these various operations. Spaces are also reserved for records of beating up, cleaning and thinning. If such notes were systematically entered in this little pocket register, they would in time become of considerable interest and value, as the various entries would ultimately give a complete history of the plantations to which they refer. Sufficient space is provided for any additional notes which may be found necessary. The principal value of this useful little register lies in the fact that it makes possible the recording of information in its proper place and at the proper time, and in such a form as to be readily available on any future occasion.

The Law of Forestry in Great Britain and Ireland, comprising the Law relating to Trees and the Law relating to Trespass and Game. xlviii + 400 pp., including index and tables. By Benaiah W. Adkin, Fellow of the Surveyors' Institution, etc. Price 10s. London: *The Estates Gazette, Ltd.*

The author writes in an interesting manner and very fully on the English law on these subjects, and adds short chapters dealing with Scots and Irish law. The book will be very useful to landowners, agents, students and others interested in forestry in England, and also, although in a less degree, to such readers in Scotland and Ireland, while members of the legal profession will welcome it as a valuable addition to their library. A full index and exhaustive table of cases enhance the value of the work.

Wood-Pulp and its Uses. By C. F. Cross, E. J. Bevan, and R. W. Sindall, with the collaboration of W. N. Bacon. xi + 270 pp., with 25 illustrations. Price 6s. net. London: Constable & Company, Ltd., 1911.

The above work deals in a very lucid and interesting manner with the highly important industrial subject of wood-pulp. From cover to cover the work contains a great amount of valuable and interesting information concerning an important industry to which we have in the past paid far too little attention. The authors do not claim that the book is an exhaustive monograph of the subject, but they have managed to encompass within remarkably reasonable dimensions a wonderfully complete account, from the theoretical, scientific and industrial points of view, of the constituents of wood and especially of cellulose.

To the forester who grows the wood, and to the technological expert whose scientific methods and knowledge enables him to derive materials of the highest industrial importance from that wood, this work will come as a welcome addition to the present literature of the subject.

The book touches in many places on the past history of wood-pulp, which is an extremely interesting history; but of equal interest and certainly of greater practical importance is the clear and concise information given regarding the present position of the industries which rely on wood-pulp as their raw material; and last but not least many suggestive hints are given which indicate possible lines for further investigation, that is, the lines along which future research might be pursued with a view to

the solution of certain problems which, if once successfully solved, would add very materially to the future prosperity of the industries concerned in the manufacture of wood derivatives. There are great opportunities here for co-operation between the scientist and the manufacturer, and if the book succeeds (as we think it ought to) in one of its objects, namely, that of sustaining and awakening the interest of readers and students, it will have served a purpose of national importance. A very useful bibliography and index are added at the end. The book is well printed and contains many well-reproduced illustrations.

OBITUARY.

The Late Mr David W. Thomson.

By the death of Mr D. W. Thomson, which occurred on the 11th of March last, the Council of the Royal Scottish Arboricultural Society has lost an esteemed member, and the Edinburgh nursery and seed trade one of its most popular representatives. On leaving school, Mr Thomson served an apprenticeship to gardening under his father, the late Mr David Thomson, at Drumlanrig. He afterwards spent some time in the nurseries of Messrs James Veitch & Sons at Chelsea, and in 1876 he commenced business as a nurseryman and seedsman in Edinburgh. He became a member of the Royal Scottish Arboricultural Society in 1893, and at the time of his death was serving his second term of office as a Councillor. He was intimately associated with the horticultural societies in Edinburgh, and at the time of his death was the senior vice-president of the Royal Caledonian Horticultural Society. He was an ex-president of the Scottish Horticultural Association, of which he was one of the original members, and for a number of years was a member of the council of the Horticultural Trades' Association of Great Britain and Ireland He was also a Fellow of the Royal Horticultural Society and of the Edinburgh Botanical Society, and amongst bodies outside forestry and horticulture he occupied the position of Moderator of the Holyrood High Constables, with whom he had been connected for a number of years. Mr Thomson was a generous contributor to charitable and other objects connected with forestry and gardening, and personally he was one of the most likeable of men.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1914.—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Show-yard at Hawick, on Thursday, 16th July 1914, at 2.30 P.M. In the unavoidable absence of the President, Mr CHARLES BUCHANAN, Vice-President, was Chairman of the meeting, which was well attended.

MINUTES.

The CHAIRMAN explained that the Minutes of the Annual Meeting were now in print, and would be circulated along with the *Transactions* in the course of next month. The Minutes were accordingly held as read and approved.

APOLOGIES.

Apologies for absence were intimated from the President; Sir John Stirling-Maxwell, *Honorary Secretary;* Sir James Bell of Montgreenan; Mr James Whitton, Glasgow; Mr James Johnstone, Ayr, and others.

DEATH OF MR ELIS NILSON.

THE CHAIRMAN said he was sure that the members would desire to record in their Minutes the loss which the Society had sustained through the death of Mr Elis Nilson, one of the Foreign Honorary Members of the Society, and a gentleman who was known to many of them by his visits to this country, and who had rendered great service to the Society when the

members visited Sweden in 1902. He explained that the Council had already sent their sympathy to Mrs Nilson, but he thought it right that the members in General Meeting should pass a motion to the effect suggested. This was unanimously agreed to.

Chairman's Remarks.

The Chairman explained that as he had expected the President would be present to take the Chair, he had not prepared any remarks for the occasion, but he asked the Secretary to read the following letter which he had received from the President:—

15*th July* 1914.

Dear Mr Galloway,

I am very sorry that a bad cold and consequent loss of voice will prevent me from being present at the Society's meeting at Hawick.

However, after the recent Edinburgh meeting, I should have very little to say except to congratulate the Society on the success of its Diamond Jubilee Celebrations.

The emphatic opinion expressed by our guests (which will no doubt be amplified in the notes which some of them are to send to the *Transactions*) should leave no doubt of the prudence of the policy advocated by the Society, and it is to be hoped that the plain speaking from those members of the Society who have been in contact with Government officials and Departments, will lead the public to fix the blame for the absence of progress in the proper quarter.

The obstruction with which we are met would needs give way before an insistent popular demand. Unfortunately the voice of country districts is little heard in Parliament as compared with the voice of the industrial population of the towns. Lord Lovat's plea for the education of our legislators points to the first step towards public demand which could not be denied.

Yours very truly,

Archibald Stirling.

Judges' Report on the Essays.

The Secretary gave in the awards on the Essays received, as follows:—

1. "Treatment of Forest Crops up to Middle Age." By "Do not Plant a Hundred Acres when You can only look after Fifty." No Award.

2. "Pine Weevil Traps" (illustrated). By FRED W. LAW, M.A., B.Sc., 30 Beaconsfield Place, Aberdeen. Award—a No. 2 Silver Medal.

3. "The Pine Beetle." By WILLIAM S. NASH, Assistant Forester, Airds Mill, Muirkirk. Award—a No. 3 Silver Medal.

4. "The Various Methods of Working up Underwood." By E. S. GRANT, Head Forester, Bedgebury Park, Goudhurst, Kent. Award—a No. 2 Silver Medal.

5. "On the Fringe of an Old Forest" (with 3 Photographs). By "WANDERER." No Award.

6. "Removing Timber" (with 3 Photographs).
7. "Protection of Scots Pine against Black Game."
8. "Larch Canker" (*Dasyscypha Calycina*).
By ALEXANDER MACPHERSON, Forester, Poltalloch, Kilmartin, Argyll. Award—a No. 2 Silver Medal.

EXHIBITION AT HAWICK.

The SECRETARY explained that the Judges' awards in these Competitions had already been published in the newspapers, and it was agreed that they should be held as read. The awards were as follows :—

Competition No. I.

Specimens of the Timber of Scots Pine (*Pinus silvestris*).

1st Prize,	£1,	Sir John A. Dewar, Bt., of Dupplin, *per* James A. Donald.
2nd ,,	15s.,	The Right Hon. The Earl of Minto, *per* Francis Berry.
3rd ,,	10s.,	The Duke of Buccleuch, *per* David Crabbe, Eskdale Estates.

Competition No. II.

Specimens of the Timber of Norway Spruce (*Picea excelsa*).

1st Prize,	£1,	Sir John A. Dewar, Bt.
2nd ,,	15s.,	The Duke of Buccleuch.
3rd ,,	10s.,	The Earl of Minto.

Competition No. III.

Specimens of the Timber of Larch (*Larix europæa*).

1st Prize,	£1,	The Earl of Minto.
2nd ,,	15s.,	Sir John A. Dewar, Bt.
3rd ,,	10s.,	The Duke of Roxburghe, *per* George Leven.
Commended		The Duke of Buccleuch.

Competition No. IV.

Specimens of the Timber of Ash (*Fraxinus excelsior*).

1st Prize,	£1,	The Earl of Minto.
2nd ,,	15s.,	The Duke of Buccleuch.
3rd ,,	10s.,	Captain Stirling of Keir.

Competition No. V.

Specimens of the Timber of Oak (*Quercus robur*).

1st Prize,	£1,	The Earl of Minto.
2nd ,,	15s.,	The Duke of Buccleuch.
3rd ,,	10s.,	Captain Stirling of Keir.
Commended		The Duke of Roxburghe.
,,		Captain Palmer Douglas of Cavers, *per* J. Leishman.

Competition No. VI.

Specimens of the Timber of Elm (*Ulmus montana*).

1st Prize,	£1,	Duke of Roxburghe.
2nd ,,	15s.,	Captain Stirling of Keir.
3rd ,,	10s.,	The Earl of Minto.

Competition No. VII.

Specimens of the Timber of any three Coniferous Trees other than the above.

A. Open Section.

1st Prize, £2, 10s., The Duke of Roxburghe.
2nd Prize, £1, 10s., Captain Stirling of Keir.
(Douglas Fir, Lawson's Cypress and *Wellingtonia gigantea.*)
3rd Prize, £1, Sir John A. Dewar, Bt.
(Silver Fir, Douglas Fir and Lawson's Cypress.)

B. Local Section.

1st Prize, £1, The Duke of Roxburghe.

Competition No. VIII.

Specimens of the Timber of any three Broad-Leaved Timber Trees other than the above.

A. Open Section.

1st Prize, £2, 10s., Sir John A. Dewar, Bt.
(Spanish Chestnut, Sycamore and Beech.)
2nd Prize, £1, 10s., The Duke of Roxburghe.
3rd Prize, £1, The Duke of Buccleuch.

B. Local Section.

1st Prize, £1, The Duke of Roxburghe.

Competition No. XI.

Gate for Farm Use, manufactured from Home-grown Timber shown in working order (confined to Foresters).

James A. Donald, Forester, Dupplin, Perth. No. 1 Silver Medal.
Lewis S. Rae, Assistant Forester, Dupplin. No. 1 Silver Medal.
D. M'Millan, Forester, Keir, Dunblane. No. 2 Silver Medal.

Competition No. XII.

Gate, manufactured from Home-grown Timber, shown in working order.

James A. Donald, Forester, Dupplin. No. 1 Silver Medal.
W. M. Price, Factor, Minto, Hawick. No. 2 Silver Medal.
Francis Berry, Forester, Minto. No. 2 Silver Medal.
Captain Sprot of Riddell. No. 3 Silver Medal.

Competition No. XIII.

Self-closing Wicket Gate made from Home-grown Timber.

The Duke of Buccleuch. No. 1 Silver Medal.

Competition No. XV.

Full-size section of the best Rustic Fence made from Larch or other thinnings.

Captain Sprot of Riddell. No. 3 Silver Medal.

Competition No. XVIII.

Specimens of Stems illustrating the effects of Dense and Thin Crops in Branch Suppression and quality of Timber.

Duke of Roxburghe. No. 1 Silver Medal.

Captain Sprot of Riddell (2 stems Spruce 40 years old). No. 3 Silver Medal.

Competition No. XIX.

For a collection of Fungi injurious to Forest Trees and Shrubs.

Hugh R. Munro, The Park, Great Witley, Worcester. No. 1 Silver Medal.

George Fraser, Midhope, Hopetoun. No. 2 Silver Medal.

Andrew Fish, Ladywell Cottage, Kinneil Estate, Bo'ness. No. 3 Silver Medal.

Competition No. XXI.

For any useful invention or marked improvement on any of the Implements or Instruments used in Forestry.

The Duke of Buccleuch (Portable Tramway and Bogies). No. 2 Silver Medal.

Robert G. Grant, The Manse, Aberdalgie, Perth (Stump-jack or Root Lifter, with Lever, Chain and Hook). No. 3 Silver Medal.

Robert G. Grant, The Manse, Aberdalgie, Perth (Pit-trap for Rabbits). Bronze Medal.

Medals were awarded to the following for Articles sent in for Exhibition only, namely:—

The Duke of Roxburghe. No. 1 Silver Medal for Stems of Japanese and European Larch.

Lochiel, Achnacarry. No. 3 Silver Medal for Specimens of Timber.

G. P. Gordon, B.Sc. No. 1 Silver Medal for Photographs showing method of eradicating bracken.

Charles Burton, Longtown, Staffs. No. 1 Silver Medal for a collection of Wooden Flowers made from pit Timber and forest Timber.

The Earl of Mansfield, *per* Frank Scott. No. 2 Silver Medal for specimens of Transplanted Seedlings and Frame used in the transplanting.

W. A. Edmond, Joiner, Floors Castle. No. 2 Silver Medal for articles of Turnery.

The following received Medals for their collections of Exhibits:—

The Duke of Buccleuch. No. 1 Silver Medal.
The Duke of Roxburghe. ,,
Captain Palmer Douglas. ,,
William Peffers, Electric Sawmills, Hawick. No. 1 Silver Medal.
The Earl of Minto. No. 2 Silver Medal.
Sir Duncan E. Hay, Bt., of Haystoun. No. 2 Silver Medal.
Sir John A. Dewar. No. 2 Silver Medal.
Captain Sprot of Riddell. ,,

The Judges' awards were unanimously approved of.

Nursery and Plantation Competitions.

(*Restricted to the Hawick Show District.*)

I. NURSERIES.

Class I.

For the best managed Estate Nursery not exceeding two acres in extent.

F. R. S. Balfour, Dawyck. Gold Medal.
Captain Sprot of Riddell. Bronze Medal.

Class II.

For the best managed Estate Nursery exceeding two acres in extent.

The Earl of Minto, *per* F. Berry. No. 1 Silver Medal.
The Duke of Roxburghe, *per* G. Leven. Bronze Medal.
The Lord Binning of Mellerstain, *per* G. H. Dove. Highly Commended.

II. PLANTATIONS.

Class IV.

For the best young Plantation, mainly of Conifers, not exceeding ten years of age, and not less than 5 acres in extent.

Duke of Roxburghe (Nine-year-old plantation of Japanese Larch). No. 1 Silver Medal.
F. R. S. Balfour, Dawyck (Five-year-old plantation of Menzies Spruce). Bronze Medal.

Captain Sprot of Riddell (Mixed coniferous plantation four to five years old). Bronze Medal.

Duke of Roxburghe (Bowmont) (Seven-year-old plantation). Bronze Medal.

F. R. S. Balfour, Dawyck (Six-year-old Japanese Larch plantation). Highly Commended.

The Judges' awards in these competitions were approved of.

Diamond Jubilee Celebrations.

It was reported on behalf of the Diamond Jubilee Committee that the Tour, Conference and Dinner had been very successfully carried through, and that the Society's guests had expressed themselves as highly satisfied with the country and with the arrangements made for their comfort. Letters of thanks had been received from the gentlemen who had been elected to the Honorary Membership of the Society.

The Chairman mentioned that the Society was greatly indebted to the President, Sir John Stirling-Maxwell and Sir John A. Dewar, who had been kind enough to lend their motor cars during the first week of the tour; and also to the President, Sir John A. Dewar and Mr Fothringham of Murthly for entertaining the foreign and colonial guests for the first week-end embraced in the tour; and to Sir Ronald Munro Ferguson, Mr Hector Munro Ferguson and Mr J. Harry Dods, Factor, Novar, for entertaining a number of the guests during the second week-end.

It was mentioned that the Council had elected Mr R. G. Robinson, New Zealand, and Mr K. A. Carlson, Orange Free State Conservancy as Correspondents in their respective countries, and these elections were confirmed by the Meeting.

The Chairman concluded his remarks on this subject by appealing for new members, and urged that each member should endeavour to help in this matter.

The Chairman mentioned that Mr Rauner, representative of Russia, had brought with him a piece of silver plate in the form of a Quaich as a present from the Russian Ministry of Agriculture, and a conversation took place as to the custody of the Quaich. The matter was ultimately remitted to the Council.

Mr James Watt pointed out that at the General Meeting at Paisley last year, a Resolution moved by him had been carried, authorising subscriptions to be taken up for the purchase of a President's badge, and he asked why the Resolution had not been given effect to or rescinded. Some discussion took place on the subject, and the Resolution was then formally rescinded.

Excursion 1915.

The Chairman mentioned that the Council had considered as to a locality for next year's Excursion. Two places had been mentioned, namely, Wales and the district of Ireland in the neighbourhood of Dublin, and the Council's recommendation was in favour of the visit to Ireland. The Meeting agreed with this recommendation, and remitted the matter to the Council.

Development of Afforestation.

On this subject the Chairman said there was little to add beyond what had been said at the Conference and Dinner. He pointed out that the Diamond Jubilee Party had visited the Loch Ordie area mentioned by Lord Tullibardine in his speech of 22nd April, and also Ballogie, in the course of their tour, and that the unanimous opinion of the party was in favour of Ballogie. So far as the Council was aware no further steps had been taken since the Annual Meeting to acquire a Demonstration Area, and he proposed that this Meeting should re-affirm the Society's Resolution of 7th February last, and he accordingly moved the following Resolution:—

> "That this Meeting of the Society re-affirms the Society's Resolution of 7th February last to the effect that the Government should acquire, without further delay, the Ballogie Area on Deeside for Demonstration purposes; and should also select and purchase, as soon as possible, supplementary areas in other districts of Scotland for further demonstrations."

Mr J. H. Milne Home, Irvine House, Canonbie, in seconding the Resolution, expressed the hope that the Area would be purchased before another meeting of the Society.

Mr Francis Berry, Forester, Minto, Hawick, who supported the Resolution, said that he had known Ballogie from his early boyhood, and he thought it would be a very suitable Demonstration Area.

The motion was unanimously agreed to.

Valuation of Woodlands for Rating Purposes.

The Secretary explained that the Council had appointed a Committee to look into this matter; that a meeting on the subject had been held with the Scottish Branch of the Land Agents' Society, and that the finding of the joint meeting was that Proprietors should take more advantage of their privileges of negotiation with Assessors, and, if necessary, should appeal to the Valuation Committees, and failing satisfaction from them to the Lands Valuation Appeal Court in Edinburgh. He urged that members who knew of cases of hardship should send in particulars which would be helpful to the Committee in endeavouring to find remedies where these were required.

Notice of Motion.

Notice on behalf of the Council was given of the following motion, to be discussed and disposed of at the next meeting :—

"That Law XIV. as it at present stands be rescinded, and the following new Law be substituted for it, viz.:—

"The affairs of the Society shall be conducted by a President, five Vice-Presidents and twenty-five Councillors, with Secretary, Treasurer and Auditor; provided always that nothing herein contained shall prevent the same person being appointed both Secretary and Treasurer. The President, one Senior Vice-President, five Senior Councillors, Secretary, Treasurer and Auditor shall retire annually; but the President, Secretary, Treasurer and Auditor shall be eligible for re-election. The retiring Vice-President or one of the retiring Councillors may be elected as President, and one of the retiring Councillors may be elected as Vice-President, but the retiring Vice-President or retiring Councillors shall not be eligible for re-election to the same office till after the expiry of one year. The other vacancies shall be filled by the election of eligible members of the Society. Every member who

has filled the office of President shall be eligible for election by the Council as an Honorary Life Member of the Council."

Telegraph, Etc., Poles.

The Secretary read a circular issued by the Post Office to the Press on the subject of the supply of poles for telegraph and telephone purposes. Some discussion followed, in the course of which one applicant for particulars remarked that he had received no reply from the Post Office to his letter.

The Secretary was instructed to communicate with the Controller of Stores on the subject, and to suggest that the conditions regulating the inspection of the poles should be modified.

The meeting was closed by a vote of thanks to the Chairman for presiding.

Royal Scottish Arboricultural Society

Prizes Offered for Papers—1915.

The Council has decided to discontinue the Syllabus of specific subjects for which prizes are offered, and to award medals or their converted values for papers dealing with any branch of forestry. They hope that the new arrangement will not only serve to increase the number of papers submitted in competition, but will place at the Hon. Editor's disposal a large number of valuable papers suitable for publication in the *Transactions*.

In this connection they invite attention to the late Hon. Editor's appeal for literary contributions, printed at p. 234 of Vol. xxvi., from which an extract containing suggestions as to the class of papers which would be welcomed is here given :—

"The subjects on which communications would be welcome are numberless, but a few of them may be mentioned by way of suggestion :—

Nature of localities here found to be most suitable for forest crops of various species, including exotics.

Species, including exotics, here found to be most suitable as forest crops in localities which are unfavourable from various causes, such as high elevation, exposure to cold or strong wind, frost, bog, etc.

Cheap and successful methods of planting.

Successful "direct" sowings.

Successful natural regeneration.

Successful treatment of crops up to middle age, especially with regard to mixed crops.

Successful under-planting of crops of light-crowned species.

Successful protection of nurseries and forest crops from injury by animals, birds, insects, fungi, weeds, smoke or meteoric phenomena (such as frost, wind, snow,etc.).

Successful use of mechanical appliances for the moving of timber.

Cheap and successful methods of increasing the durability of timber.

Cheap and successful methods of converting and seasoning timber.

Utilisation of waste wood (slabs, tops and branches, etc.).

But of course there are many other subjects.

As a rule, successful operations are more instructive than failures, but where the cause of non-success can be indicated with certainty, an account of such failure may be of much interest and value."

Conditions to which Writers must conform.

The Judges are empowered to fix the value of the Medals to be awarded according to the respective merits of the Essays.

All Essays, Reports, Models, or other Articles intended for Competition must be lodged with the Secretary not later than Monday, 10th May 1915. *Each such Essay, Report, Model, or Article must bear a* MOTTO, *and be accompanied by a sealed envelope bearing outside the* SAME MOTTO, *and containing a* CARD *with the* NAME, DESIGNATION, *and* ADDRESS *of the Competitor.*

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Manuscripts for which medals have been awarded, or which have been wholly or partly reproduced in the Transactions, *become the property of the Society and are not returned to their authors.*

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 *Silver Gilt,* £3; No. 2 *Silver,* £2; No. 3 *Silver,* £1; *Bronze,* 10s.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1915.

THE ANNUAL MEETING.

The Sixty-second Annual Business Meeting of the Society was held in the Goold Hall, 5 St Andrew's Square, Edinburgh, on Saturday, 6th February 1915, at 1 P.M., and was attended by about forty members. In the unavoidable absence of Colonel STIRLING of Keir, President of the Society, SYDNEY J. GAMMELL, Esq., of Drumtochty, Vice-President, was called to the Chair. The Board of Agriculture for Scotland was represented by JOHN D. SUTHERLAND, Esq., Commissioner for Small Holdings and Chairman of the Advisory Committee on Forestry.

APOLOGIES.

The SECRETARY intimated that apologies for absence had been received from the President, Lord Lovat, Vice-President, and Mr Irvine of Drum, who were all on active service; and from Sir Kenneth Mackenzie, Sir Andrew Agnew, Sir Arthur Mackenzie of Coul, and Messrs Robert Allan, J. F. Annand, A. T. Gillanders, John A. Howe, H. Rutherfurd, and John M'Kerchar.

The PRESIDENT'S letter, dated from the camp of the 2nd Lovat Scouts in England, was read to the meeting by the Chairman, as follows:—

"I am very sorry my duty here will not allow me to be present at the Annual Meeting.

"If the Society does me the great honour of electing me as their President for another year, I shall accept it not as establishing a dangerous precedent for an absentee holder of the office, but as a mark of the Society's goodwill towards those members who have been called up for service in His Majesty's forces.

"The Society, in common with the greater part of the world, has grave cause to complain of the war which has been forced upon our country by the aggression of Germany. We regret it all the more because the Society has had pleasant relations with German foresters in the past, and because Scottish arboriculture owes a great deal to German research and German practice.

"The war comes as an unwelcome disturbance of all peaceful economic progress, and it is only too likely to limit and hamper the progress of silviculture by diverting public expenditure into other channels. It is true that in the case of silviculture in Scotland this expenditure has hitherto been rather a matter of hope than of reality.

"The Society will no doubt continue to press the claims of afforestation in Scotland, for which an unanswerable case has been established by the unanimous testimony of our foreign and colonial guests in 1914."

Minutes.

The Minutes of the General Meeting, held at Hawick on 16th June last, which had been printed and circulated with the *Transactions*, were held as read and adopted.

Report by the Council.

The Council's Report was as follows:—

The Society's Diamond Jubilee year—1914—will be a memorable one to the members, not only as arboriculturists but as citizens of this great empire. The celebration of the Society's sixtieth anniversary had just been successfully concluded, when the great war broke out, which has now been raging for six months with, unhappily, little prospect of a speedy settlement.

Membership.

With such a war in progress, almost at our doors, it was only to be expected that many members of this Society would take their places amongst the active defenders of our country, and that casualties would be sustained. It is not possible to say accurately what those casualties have been up to the present time, but the following at least are known to have fallen:—Sir Archibald Gibson Craig, Bart., of Riccarton; Colonel Aymer Maxwell, Yr. of Monreith; and the Master of Kinnaird. As you are aware, a Roll of Honour is being prepared which will be published in the *Transactions*.

In addition to these war casualties the usual list of deaths has to be recorded. This list includes the following names:—Sir John Ramsden, the father of the Society; the Duke of Buccleuch; the Earl of Stair; Sir John Macpherson Grant; Major Stirling of Fairburn; Colonel Campbell Walker; Mr

W. L. Nicol of Ballogie; Mr W. J. Woodman-Smith; Mr A. M. Burn Murdoch; Mr Alex. Pollock; Mr Colin M. Cameron; Mr James Crabbe, Glamis; Mr William Fisher, Wentworth; Mr D. Tait, Owston Park; Mr D. G. Shiell; Mr John Brunton; Mr P. D. Gow; Mr W. G. Mitchell; and Mr Alex. Wight; with Mr Elis Nilson, Sweden, and Dr John Nisbet, who were both Honorary Members of the Society. The total members at the date of last report was 1425. Ninety-five new names have been added to the Roll in the course of the year, but 88 have had to be removed owing to death, resignation, lapsing or other cause. The membership at this date is, therefore, 1432.

The Hon. Secretaryship.

Members will recollect that at last Annual Meeting, Sir Ronald Munro Ferguson, who had been so long associated with the Society as President and Hon. Secretary, resigned the latter office, owing to his appointment as Governor-General of Australia. The Society's message to Sir Ronald, and the reply received from him, were duly recorded in the "Proceedings" of that meeting, which are appended to the Diamond Jubilee part of the *Transactions*. The Society was exceedingly fortunate in securing Sir John Stirling-Maxwell as his successor in the office.

Diamond Jubilee Celebrations.

The programme outlined in the Council's last report for the suitable celebration of the Society's Diamond Jubilee was successfully carried out. The following countries accepted the Society's invitation and sent representatives, viz.:—Denmark, France, Holland, Hungary, Russia, Sweden, India, Canada, New Zealand and South Africa. A number of representative silviculturists from England, Wales, Ireland and Scotland were also invited to accompany those foreign and colonial guests on the Tour of Inspection of Woods and Afforestable lands in Scotland. At Oban these guests were joined by the Society's Annual Excursion party, numbering about 80, on a three days' tour in Argyllshire. On returning to Edinburgh, the Diamond Jubilee guests were entertained by the Corporation to a drive through the city and neighbourhood, and to a luncheon in the City Chambers. In the afternoon of the same day a Conference was held, when the Society's guests had an opportunity of expressing their views on what they had seen, and the proceedings were brought to a close by a dinner in the evening, at which the Lord Provost, amongst other guests, was present.

Unfortunately the Secretary for Scotland, the President of the Board of Agriculture and Fisheries, and the Scottish Members of Parliament were, owing to the political situation, prevented from attending.

There was a large attendance of members of the Society at

both the Conference and Dinner. At the close of the Dinner, M. Rauner, the representative of Russia, handed to the President, on behalf of the Society, a beautiful piece of silver plate—in the form of a fruit dish made in the old Crimean style and set with two carbuncles and one chalcedony—as a present from the Russian Imperial Ministry of Agriculture. It has been deposited for safe custody with Messrs Hamilton & Inches.

In the course of the Conference the Honorary Membership was conferred on the six foreign representatives present. There being only four vacancies on the list for Home and Colonial Honorary Members, two of these were given to colonial representatives and two to home members. The representatives of New Zealand and South Africa were subsequently elected Correspondents of the Society in their respective countries.

To meet the expenses of the celebrations, the Excursion Fund of £187, 18s. 7d. was converted, for the time, into the Diamond Jubilee Fund, to which the special contributions received were added. The Board of Agriculture for Scotland gave a generous donation of £150; the Society gave £100 odds; and a number of the invited home guests contributed £90. In addition to these cash payments, the following entertained some of the guests for a week-end, viz.:—The President, Sir John A. Dewar of Dupplin; Mr Fothringham of Murthly; and Sir Ronald Munro Ferguson: and the following generously gave the use of their motor cars for the first week of the tour, viz.:—the President; Sir John Stirling-Maxwell; Sir John A. Dewar; and Mr Elwes.

His Majesty the King, the Princess Royal, and other proprietors not only most cordially permitted their woods to be visited, but also hospitably entertained the Society's guests. The Committee is most grateful to all who in these various ways contributed substantially to the success of the proceedings.

The resources thus put at the disposal of the Committee were found to be ample for the purpose, and the Excursion Fund has been restored to its former position with a balance at its credit of about £50.

A full report of the proceedings was printed in the Diamond Jubilee number of the *Transactions*, which was held back beyond the usual time to allow of this report being included. A reprint of the report has also been sent to Ministers and all the Scottish Members of Parliament, with a circular drawing their attention especially to the resolution passed by the foreign and colonial guests on the subject of the suitability of Scotland as a field for afforestation.

A large photograph of the Excursion party, taken at Benmore, has been presented to the Diamond Jubilee guests with the exception of Messrs Pardé and Czillinger, whose copies have been held back, meantime, owing to the war.

At the meeting which was held at Hawick, it was decided that next Excursion should be made to the district of Ireland in the neighbourhood of Dublin.

Transactions.

Two parts of the *Transactions* have been issued since last Annual Meeting. The Diamond Jubilee part includes the reports of the celebrations already referred to, and also the Index to the *Transactions* which was prepared at the instigation of the Earl of Crawford, who most generously defrayed the expense. It is hoped that the Index will be of great service to members and those institutions which receive the Society's *Transactions*. Many other interesting and valuable papers are included in these two parts, which, unfortunately, a number of members have not been able to see because of delay in forwarding their subscriptions. On this occasion the list of arrears is much larger than usual, but this is believed to be due to the war.

Exhibition at Hawick.

The usual Exhibition of Forestry in the Highland and Agricultural Society's Show was held at Hawick. The catalogue contained 90 entries in all, 70 being in the Competitive section, and 20 in the section for Exhibition only. The local Committee were Messrs Price, Leven, Leishman and J. H. Milne-Holme; and Mr F. L Buttar, Student of Forestry, was a very efficient attendant. The judges were Messrs ANNAND, MITCHELL and SPIERS.

The thanks of the Society are specially due to Mr Price for the assistance provided by him in connection with the reception, staging and removal of the various exhibits.

The schedules in connection with the Exhibition, which is this year to be held at Slateford, Edinburgh, were issued with the notice calling this meeting. Members will see that slight alterations have been made upon them. The timber boards which last year were permitted to be from 4 to 7 feet in length are now restricted to form 6 to 7 feet; and different scantlings of timber are invited for exhibition instead of merely different kinds of timber.

The proposal that a tree-felling competition should be held in connection with the Exhibition has been remitted to the Education Committee for consideration, along with other matters affecting the practical training of assistant foresters. A remit has been made by the Council to the Committee to consider as to the advisability of the Society acquiring a suitable building for exhibition purposes instead of being dependent annually upon the canvas shed which has been supplied by the Highland and Agricultural Society.

Nursery and Plantation Competitions.

The third of these competitions, which it is hoped will now be held annually, took place within the Show district, being the counties of Berwick, Peebles, Roxburgh and Selkirk. Five nurseries were entered—two in class 1, for nurseries not exceeding 2 acres in extent, and three in class 2, for nurseries exceeding 2 acres. Eight entries were received in the Plantation competition—seven being in class 4—mainly conifers not exceeding 10 years of age, and not less than 5 acres in extent, confined to estates having more than 300 acres under woods, and one in class 5, in which the age is from 10 to 20 years. No hardwoods were entered. The judges were again Dr BORTHWICK and Mr G. U. MACDONALD.

Essays.

In the Essay competition, five essays and three notes were received and submitted to the Judges. Of the essays two obtained No. 2 Silver Medals, one a No. 3 Silver Medal, and two were not considered worthy of any award. A No. 2 Silver Medal was awarded to the writer of the three notes. Unfortunately no essays were received in competition for the special prizes, amounting to £15, 15s., offered by the President in connection with the Diamond Jubilee. A list of the suggested subjects was printed in the January *Transactions*, but members are reminded that they are entitled to write on any subject they choose connected with forestry.

General Meeting.

The General Meeting was held in the Showyard at Hawick, on Thursday, 16th July, when the Judges' awards in these various competitions were submitted and approved, and other business transacted. The proceedings, containing the Prize lists, are appended to the *Transactions* which were issued in the course of last month.

Prizes and Certificates.

As will be seen from the Accounts the prizes awarded in the various competitions consisted of £56, 10s. in cash; £24, 17s. 6d. in medals; and £5, os. 6d. in books. To account of the cash prizes the Highland and Agricultural Society paid £20, and the directors of that Society have again been good enough to intimate that they will offer a like sum towards the prize list this year.

Amongst the medals awarded was one Gold Medal to Mr Balfour, Dawyck, for his nursery.

Last year a certificate was given along with each medal or prize awarded, but the Council has now decided that one certificate

only will be given to each prize winner, and where more than one prize has been gained, a note of these prizes will be written upon the certificate.

Development of Afforestation.

The resolutions on the subject of the acquisition of a Demonstration area and the appointment of Advisory and Research Officers, which were passed at last Annual Meeting and included in the report of the discussion on Forestry in Scotland held that day, and printed in the Diamond Jubilee part of the *Transactions*, were duly forwarded to the Prime Minister, the Chancellor of the Exchequer, the Treasury, the Secretary for Scotland, the Board of Agriculture for Scotland and the Development Commissioners. These resolutions with a reasoned statement appended were also sent to all the Scottish Members of Parliament, a large number of whom wrote expressing approval of them. A letter was subsequently received intimating that at a meeting the Scottish Members unanimously agreed to support the resolutions.

As no progress had been intimated these resolutions were re-affirmed at the General Meeting held at Hawick, and were again sent to the Ministers mentioned above. A reprint of the report of the proceedings in connection with the celebration of the Society's Diamond Jubilee, which, as was already stated, was taken part in by a number of Foreign, Indian and Colonial foresters representing their respective Governments, was sent to all the Ministers mentioned above and all the Scottish Members of Parliament, along with a circular drawing their attention particularly to the resolution passed by those distinguished guests expressing their opinion in favour of afforestation in Scotland on a large scale with the active support of the nation, and to the Society's resolution homologating that opinion and asking the support of the State.

A memorandum by the Development Commissioners on the subject of the afforestation of privately owned lands was published in the newspapers, but has now been superseded by a memorandum on the same subject published by the Board of Agriculture for Scotland. A copy of this latter memorandum and a letter from the President on the subject appeared in the *Transactions*.

The fourth annual report of the Development Commissioners to 31st March 1914 was issued in the autumn of last year, from which it appears that in the course of the year under review they had agreed to advance to the Board of Agriculture for Scotland the sum of £1500 for salaries and expenses to Advisory Officers to be attached to the three centres of education at Aberdeen, Edinburgh and Glasgow. It is understood that the Advisory Officer for the Glasgow district has now been appointed,

but so far as known the other appointments have not yet been made.

On the subject of a Demonstration Area, the Commissioners say that they were not satisfied with the two estates, Ballogie and another, brought under their notice by the Scottish Advisory Committee, and that they were endeavouring to frame a scheme which would render available for forestry demonstration and instruction a large area near the geographical centre of Scotland, and they sincerely hoped that that scheme, if it could be reduced to satisfactory and definite shape, would be accepted by all concerned as a reasonable solution of a difficult problem. It is not yet known what progress has been made with the scheme referred to.

An interesting scheme for the afforestation of the Camps Catchment area, Middle Ward, Lanarkshire, extending to about 6000 acres, which is explained by Mr Gordon in an article printed in the January *Transactions*, is understood to be receiving the support of the Development Commissioners, and it is hoped that this large undertaking will be successfully carried out.

Conferences with the Board of Agriculture.

Conferences and communications have taken place between the Council and the Board of Agriculture for Scotland on the following subjects:—

Duke of Sutherland's offer of land in the North of Scotland.
Appointment of Forestry Correspondents by the Board.
Preparation of Phenological reports.
Supply of home-grown pitwood.
The production of potash salts from woodlands and waste lands.
The utilisation of home-grown timber for building purposes, etc.

On all those subjects the Council are heartily co-operating with the Board. Some progress has been made with several of the subjects, and notes on pitwood and the production of potash salts will be found in the *Transactions*. The Council regret that further and more rapid progress was not made in connection with the pitwood problem, but they are glad to be able to say that although the Committee, on which the Society is represented, has not been able to fix prices, they have secured from the railway companies the concession of a maximum rate of 10s. per ton on all home-grown timber consigned direct to Scottish collieries from Scottish timber-growing centres.

Valuation of Woodlands for Rating Purposes.

The Secretary reported at the General Meeting at Hawick that certain negotiations had taken place with assessors and with representatives of the Scottish Branch of the Land Agents

Society on this subject, and that meantime he had advised that proprietors should take more advantage of their privileges of negotiation with assessors and, if necessary, should appeal to the Valuation Committees, and, failing satisfaction from them, to the Lands Valuation Appeal Court in Edinburgh. He urged that members who knew of cases of hardship, should send in particulars which would be helpful to the Committee in endeavouring to find remedies where these were required.

Proposed Alteration of the Laws.

The Council carefully considered the Motion and Amendment regarding the proposed alteration of the Law regulating the election of Office-Bearers which were remitted at last Annual Meeting; and the proposed new Law, giving effect to the Council's views on the subject, which is printed in the notice calling this meeting, will be submitted for consideration at a later stage of to-day's proceedings. Briefly, the Council's proposals are that the Vice-Presidents should be reduced from 6 to 5, the Councillors increased from 21 to 25; that a fifth of the Vice-Presidents and Councillors should retire annually and should not be eligible for re-election to the same office till after the lapse of a year. The normal period of service would thus be increased from 3 to 5 years, but it will be seen that the retiring Vice-President and retiring Councillors are not eligible for re-election to the same office till after a lapse of a year.

The Dunn Memorial Fund.

The greater part of the available revenue of this Fund has been expended in binding Messrs Elwes and Henry's great book on the *Trees of Great Britain and Ireland*. There remains a small balance over of 12s. 11d. to carry forward to next year.

Library.

The usual list of additions to the Library will be appended to the proceedings of this meeting, and it will include a number of items which have been kindly given by the representatives of the late Colonel Bailey. To them and other donors the cordial thanks of the Society are due for these gifts.

Telegraph and Telephone Poles.

The Post Office regulations regarding the inspection of home-grown telegraph and telephone poles have now been amended, to the effect that in certain cases the standing timber may be inspected to ascertain the probable suitability of the trees. An article on this subject is printed in the January *Transactions*.

Belgian Refugees.

As intimated in the notice calling the meeting, it has been made known that a number of refugees are capable of doing forestry work, and it would be desirable that members of the Society who cannot obtain local labour should endeavour to give employment to some of those refugees. They can only be employed on estates outside the prohibited area, which is all along the East coast from north to south. Applications should be made through the local Labour Exchange offices.

Local Branches.

Reports have been received from the Aberdeen branch, which will be submitted later in the "Proceedings." The report from the Northern branch has not yet been received, but when it arrives, the Council, with the approval of this meeting, will deal with it in the usual way.

Economic Botany Section of the Royal Scottish Museum.

In the course of the summer it was brought to the notice of the Council that alterations were being made on this section which it was feared might impair or destroy its usefulness. A joint Committee of the various Societies interested in the subject inspected the section, and found that there were ample grounds for such fears, and their subsequent interview with the Director did not reassure them. He indicated that some of the specimens might be transferred to other Museums, such as the University Forestry Class Museum, but gave no assurance that any of the specimens which had already been removed would be replaced. The Committee has accordingly been continued.

As to the Society's own specimens included in the section it appears from the "Proceedings" of the Society, at a meeting in 1886, that the then President said:—"With regard to the specimens and illustrations of Forestry which they had in their possession, the Council were unanimous in making over the collection to the Director, Colonel Murdoch Smith, R.E., for exhibition in the Museum of Science and Art, with the view of a School of Forestry being instituted at an early date."

The Council think that they should not object to the transference of these specimens to the new Forestry Museum in the University, provided the members of the Society and all others interested have reasonable facilities for inspecting the specimens in that Museum, and they have accordingly instructed their representatives on the joint Committee dealing with the whole matter, to put forward that view.

The report was unanimously adopted.

Finances.

The Abstract of Accounts, which as usual had been printed and circulated amongst the members, was formally submitted. The Secretary also submitted the accounts in connection with the Dunn Memorial Fund and the Diamond Jubilee celebrations and Annual Excursion, all of which had been duly audited.

Mr J. W. M'Hattie, Convener of the Finance Committee, in moving the adoption of the various accounts said that the money given in prizes in connection with the Annual Exhibitions and the Competitions for Nurseries and Plantations, and the like, was well spent. The Diamond Jubilee celebrations were a pretty severe tax on the Society, but even if the amount spent had been double what it was, he thought it would have been very well laid out. As they had heard from the Council's report, the actual cost to the Society for these celebrations was not much over £100. He thought the Council and the Society were to be congratulated on the position of their finances considering the large claims they had to meet, and he had very great pleasure in moving the adoption of the accounts. Sir John Stirling-Maxwell seconded, and the accounts were adopted.

Reports from Aberdeen Branch.

The Secretary having read the reports from Aberdeen branch, Mr Charles Buchanan, Penicuik, said there seemed to be some misunderstanding about the Aberdeen branch not being represented on the Diamond Jubilee Tour. It should be known that the President of the branch, Mr Irvine of Drum, who represented the branch on the Council, was invited.

The Chairman said:—"I think the position is this, that the branch is now properly represented on the Council by its President or by one other member put forward by the branch. The President or that other member of the Council had the opportunity of going on the Jubilee Tour. Unfortunately, Mr Irvine was not able to take advantage of it, but he would have done so if he had been able, and the branch in that way would have been represented. I am sure that is Mr Irvine's view of the matter, and I do not think there need be any feeling in regard to the Council on the subject."

Mr C. S. France said he considered that the invitation to the President should have been sent through the Secretary of the branch and not direct to the President.

Sir John Stirling-Maxwell, in moving the adoption of the report, said that with regard to what Mr Buchanan and Mr France had said it is quite possible that a mistake had been made in that matter. Certainly no one wished to do other than honour to the Aberdeen branch. That branch was a living thing, and the Society there was flourishing in a district where forestry was in evidence on a larger scale than in any other part of Scotland, and where it had the prospect of development.

Chairman's Remarks.

The Chairman said :—"I am very proud that you have placed me in the Chair to-day to preside over a meeting of a Society with which I am glad to say I have been for a very long time connected, and I am sure at the same time you will regret with me the absence of our President, Colonel Stirling, whose letter I read to you. Along with him many others are taking upon themselves the burden which falls upon the whole country in carrying on this disastrous war, which has been brought about in Europe by no wish of the people of Great Britain. But as it is now upon us it is our duty to see it through in the right way by every means in our power, and I am sure the Society appreciates the patriotism of those of its members who have joined His Majesty's forces and are bearing their full share of the burden which is now on the whole country. We shall have a Roll of Honour, and there will be many names upon that roll. Already the Secretary has intimation of some fifty names among our members who are now, or have been since the commencement of the war, serving in the forces of the Empire, and there will be many more names to come in. I ask you individually, those of you who may know of any of your friends who are members serving in that way, to intimate the same to the Secretary, so that the roll may be made as complete as possible. We have various things to congratulate ourselves upon, I am glad to say, during this year that has passed, and so have some of our individual members. I am sure members will join with me in congratulating Lord Lovat on the dignity of Knight of the Thistle which has been bestowed on him. Lord Lovat we look upon as one of

the most influential and certainly one of the most useful members our Society has had for a long time. Like all societies we have had our losses. You heard those who had been taken from us by death during the last year in the Secretary's report, and I wish particularly to again bring to your notice the names of two Honorary Members, Mr Elis Nilson and Dr Nisbet, who have been taken from us by death. Some of you knew Mr Nilson possibly better than I did, and some possibly knew Dr Nisbet better than I did, but I knew him very well and I am sure we all feel his loss very greatly—a loss to Scotland, a loss to silviculture, and a very great loss to the Society. Coming to the report which was presented to you, it is possibly the Chairman's business to amplify it in some small particulars. You heard that we had now got an Index to the *Transactions* completed through the generosity of Lord Crawford, for which we thank him very much as being a work very necessary to the Society, and one which will become of greater value as time goes on. That Index has now been brought up to date, and I trust it will be continued in time to come. Various other matters are referred to. One is the Nursery and Plantation competitions for which the Society has been awarding medals and prizes for the last two or three years. There is a suggestion, and I think a very good one, that the scope of those awards should be enlarged, and that the whole idea of the woodland management of an estate might well be taken into account in making those awards, and in that particular matter I think we might look to the Board of Agriculture to assist us. We say sometimes hard things about the Board of Agriculture, but I think we can say also good things, and particularly with regard to Mr Sutherland, whom we have with us to-day, and from whom we have on many occasions received most valuable assistance. I may mention one thing which has not possibly been very much published abroad. In spite of the discouragement which sometimes comes to him, he has been persistent in giving us his help, for instance with regard to the recovery of potash salts from tree refuse, and things of that kind. All these things are most useful, and we acknowledge his help, and we feel sure that we shall get the same generous help in the future as in the past. No one can pass over, on an occasion like this, the great event which took place during the past year—the celebration of the Society's Diamond Jubilee.

I make bold to say that the Society could not have taken a wiser course or a more satisfactory way of marking the attainment of the sixtieth year of its existence. Those who, like myself, had the honour of meeting the foreign representatives who came to this country on the invitation of the Society, presented through His Majesty's Government, I am sure look back with great pleasure on that visit. And we felt all the time more than strengthened in the views which we had put forward with regard to the suitability of our country for afforestation. We were told sometimes inside this Society, more often outside of it, that our ideas were much too rosy as to the prospects of profitable afforestation in this country. What we learned from our foreign friends, whose opinions cannot be gainsaid, as they represent much larger forestry organisations than we can possibly have in this country—all were men whose words carry weight throughout Europe—was that we had not been rosy enough in our prophecies. They said we had boundless possibilities. All we wanted to do was to take advantage of them. It is very pleasant, looking back on that time, to feel that by far the larger number of those who then honoured us with their presence are now on our side in this disastrous war which has been forced upon us. I am sure we have not got very much further, notwithstanding all the encouragement we have received in words, with what we as a Society are always pressing for—the development of afforestation in Scotland. The Society stands very much where it was. It will continue to press with all the power which it can use for the necessary preliminaries to the economic development of forestry in Scotland. We laid down some number of years ago what we thought was necessary—a demonstration area and a survey of the country. Unfortunately we have as yet got neither the one nor the other, but they are absolutely essential, and I think it is high time they were put into operation. I am not one of those who wish in any way to limit our patriotism to Scotland only, or to say that we should have in Scotland more than our fair share, or even our fair share, of what is going for the development of the country at large. But I am perfectly certain I am justified in saying this—that Scotland contains very much more land which is likely to be useful for the purpose of afforestation than does the country farther south. And yet we see that the expenditure made in England is considerably larger than the expenditure made in this country. Looking over some

Government contracts only a few days ago, I saw that one of the contracts let in December was for the building and equipment of the forestry buildings for the School of Forestry in the Forest of Dean. Very excellent—I would be the last to say 'don't do it'—but why will they not do the same for us here? We shall continue to press this point because we have every justification for doing so, and I trust the Government, as they are backed up by every Department which have anything to do with it, will see that this matter is no longer delayed. Now is an important time. We are at present engaged, as I say, in a war which taxes to the utmost the whole resources of the country, and what is going to happen when this war ends? We are going to have coming back to this country a very large proportion of unskilled labour. We must be ready to meet that emergency, and there is no better way in which preparation could be made than by pressing forward this question of afforestation and providing us with the essentials for bringing it into being. We cannot afford to delay, and I would strongly press on all those concerned that now is the time when we really ought to act in order to be prepared for a state of things which I trust may not be very far in the distant future. I do not think I need add anything more. There are many details into which I might go, but this is not the time for it. Our thoughts are possibly taken up with other things, and I will conclude by saying that I hope we may hear from the representative of the Board of Agriculture, who is with us, something much more definite than he has been able to give us at previous meetings.

"Meantime we proceed to the

"Election of the Office-Bearers for 1915.

"At a time like this it was the view of the Council that as little change as possible should be made in the office-bearers. I move the re-election of our President, Colonel Stirling, which I am sure will be received with most whole-hearted support by every member of the Society. I have also to move the election of Mr Buchanan and Mr Massie in room of the two retiring Vice-Presidents. Lord Lovat's name was put forward, but he desired to be relieved of the office of Vice-President for this year, but hoped that we would do him the honour of allowing him to occupy that position at some other time. To such a request we cannot say anything but 'Yes.' So Lord Lovat falls into the Council in

place of Mr Buchanan, who becomes a Vice-President. I have also to move the election of seven Councillors—Messrs A. T. Gillanders, G. P. Gordon, James Whitton, A. D. Richardson, Frank Scott, Lord Lovat, and the Earl of Crawford and Balcarres."

Mr H. M. Cadell of Grange seconded, and the motion was agreed to.

Mr J. H. Milne Home, Canonbie, moved the re-election of the Honorary Secretary, the Secretary and Treasurer, the Honorary Editor, the Auditor, and the Honorary Consulting Scientists. Mr W. H. Massie, Edinburgh, in seconding, said that the Society was admirably served by its officials. This was also agreed to. The Local Secretaries were also re-elected

Annual Excursion.[1]

Mr Charles Buchanan, Convener of the Excursion Committee, said that at the General Meeting at Hawick it was decided to visit Ireland this year in preference to Wales, which was also suggested. He thought, however, it would be wise to remit the matter to the Council and leave it to them to determine whether, in the circumstances, an Excursion should be held this year or not. This was agreed to.

Annual Exhibition.[1]

Mr Robert Forbes, Kennet, in drawing attention to the Exhibition to be held in the Highland and Agricultural Society's Show at Slateford, Edinburgh, expressed the hope that members would bring forward numerous exhibits and make the Exhibition a success. On his motion a very hearty vote of thanks was accorded to the Highland and Agricultural Society for their generous contribution to the Prize Fund.

Nursery and Plantation Competition.[1]

Dr Borthwick in a word reminded the meeting of the suggestion that the scope of the competition might be extended, and said that the point should not be lost sight of.

Development of Afforestation.

The Chairman then called on Mr J. D. Sutherland, of the Board of Agriculture, to address the meeting. He said:—"Mr Gammell and Gentlemen, I thank you for your references to the

[1] The Council decided to abandon the Excursion, Exhibition, and Nursery and Plantation Competition this year owing to the war. See Note on p. 205 of the *Transactions*.

Board and also for your references to myself. I will convey the suggestion that you have made to the Board, that they might consider the possibility of giving a prize or prizes, or assisting in some way to encourage the people to have proper working-plans of their woodlands, but I may mention that we have already in sight the appointment of three advisory officers in the three districts of Scotland, and these gentlemen will be available to all proprietors who wish to have working-plans prepared. I think that is probably a better and more permanent way of securing the proper management of planting in Scotland than perhaps by offering an award for the working-plans of an estate, or for the management of an estate, which is a somewhat unusual proposal. In connection with the demonstration area, which I believe you all have very much in your minds, I think it is best for me to make a perfectly clear and frank statement. Some years ago it was decided by the Development Commissioners and the Board of Education for Scotland, that it was desirable to have a demonstration area, in fact that it was necessary to have a demonstration area, in which to establish a school for forestry apprentices. An Advisory Committee was appointed to select a site, and I think in 1911, or early in 1912, they made a very full report, and that report you all know about. Then the Board of Agriculture came into existence, and the Board of Agriculture was asked to consider the whole question. The Board did consider it, and the Secretary for Scotland asked some gentlemen whom you know to assist the Board, and to advise them in the selection of a proper place for the demonstration of forestry in Scotland. The Committee searched the whole of Scotland, not in a cursory way, but in a very thorough manner indeed. You know how difficult it is to find an ideal place for the demonstration of forestry. You must of necessity have growing woods of various ages. You should have healthy woods, also young plantations, and you should have land that pertains as nearly as possible to the general character of plantable land in Scotland. That seems to me to be a short description, at all events, of what a demonstration area should consist of. The Committee found in Aberdeenshire land and woods that they considered in every way suitable, and they so reported. The views of the Advisory Committee have been confirmed by every reliable forestry expert in Scotland. I know of no one who has been consulted about that area who has said one word unfavourable to it. The Board

passed the recommendation on to the Development Commissioners. The Development Commissioners, as you heard to-day and have already, I think, heard frequently before, came to the conclusion that the selection of this area was not a proper one, and they informed the Board that they would endeavour to find a suitable place nearer the centre of Scotland than the area in Aberdeenshire. They did select a place—being the area surrounding Loch Ordie in Perthshire—and they also negotiated for, not a purchase of it, but a lease. The general terms of the lease had come before the Board for consideration. The Board, fortified by the views of the Advisory Committee, and supported strongly by the late Dr Nisbet, intimated that, as advised, they could not approve of the terms proposed for the purposes of forestry demonstration. The Board were of opinion that the area which I have described to you should certainly belong to the State. The proposal of the Development Commissioners was that the area should be leased for a period of years, and at the end of that period certain arrangements would have to be made whereby either a new lease would be entered into or the proprietor of the land would step in again and take over the crops. In the latter event the demonstration area carried on for 100 years or so would revert to the owner of the land, probably upon quite reasonable terms, but the result would be that the continuity of the demonstration would end. The position now is, as far as I can gather, that we shall have to begin again. The Board will have to consider the question afresh, and no doubt they will, as far as possible, take all those interested in afforestation into their confidence. I should now like to refer briefly to one or two other matters connected with forestry. The Development Commissioners have proposed, because they are not allowed to lend money to landlords for planting, to permit the Board to lease land for that purpose, and the terms proposed by the Development Commissioners have been already made public. I would like that these terms should be carefully considered by the Society and the members, and I would be very glad to have any observations or criticisms they might have to make upon them. Local authorities have obtained the privilege of borrowing money from the Development Commissioners for planting which has been denied to the private landowner; and it is most hopeful to find that the Mid-Lanark District Committee have actually secured an area of about

6000 acres, which they are going to devote to a proper scheme of afforestation. I do not know of 1000 acres elsewhere in Scotland utilised for the same purpose by a local authority. In the Board's general operations this year we have had certain things to do because of the war. Whether they will be helpful or not I do not know. We must judge by the results. We have found that there was much to learn about the supply of pitwood, and we were glad of the help of the practical forester as well as the scientist. I hope we may very soon be able to publish a report upon the whole investigation into that subject. I would, however, like to say that I hope the growers of pitwood will not all want to sell it at once. All the wood now growing in Scotland will be required during the next two or three years, and it would be a great misfortune if growers should lose any benefit that there might be to them by a wise conservation in that respect."

The CHAIRMAN said:—"I am sure the meeting will join with me in thanking Mr Sutherland for having come here to-day, and for the extremely frank statement he has made to us on a subject which we all appreciate so much."

MOTION TO BE DISPOSED OF.

Mr J. W. M'HATTIE moved the following motion on behalf of the Council:—

"That Law XIV. as it at present stands be rescinded, and that the following new Law be substituted for it, viz.:—

> "The affairs of the Society shall be conducted by a President, five Vice-Presidents and twenty-five Councillors, with Secretary, Treasurer and Auditor; provided always that nothing herein contained shall prevent the same person being appointed both Secretary and Treasurer. The President, one Senior Vice-President, five Senior Councillors, Secretary, Treasurer and Auditor shall retire annually; but the President, Secretary, Treasurer and Auditor shall be eligible for re-election. The retiring Vice-President or one of the retiring Councillors may be elected as President, and one of the retiring Councillors may be elected as Vice-President, but the retiring Vice-President or retiring Councillors shall not be eligible for re-election to the same office till after the expiry of one

year. The other vacancies shall be filled by the election of eligible members of the Society. Every member who has filled the office of President shall be eligible for election by the Council as an Honorary Life Member of the Council."

He said that the motion now submitted was the result of a compromise arrived at after giving careful consideration to the motion brought forward at last Annual Meeting, and to the views expressed by the mover and seconder of that motion, and of the members who took part in the discussion. The principle of the former motion was adopted in this one, namely, that retiring members could be promoted to any available vacancy but could not be re-elected. It was further proposed that the period of service should be extended from 3 to 5 years. He hoped the new motion would receive the support of the meeting.

Mr A. D. Richardson seconded the motion, which he said embodied the principle of his motion which was discussed last year.

Mr C. S. France, Aberdeen, moved certain verbal amendments —which he had previously intimated to the Secretary—the object of which he explained was to ensure that one-third of the Council and not one-fifth, as proposed by the motion, should retire annually. He also proposed to delete the last paragraph of the motion referring to the election by the Council of past Presidents as Honorary Life Members of the Council.

Mr John Campbell, Land Steward, Carron House, seconded, and said that Councillors should be drawn from a wider area than had been the case in the past.

Mr John Leishman, Cavers, and Mr Charles Robertson, Colstoun, both thought that more members should have the opportunity of serving the Society on the Council or otherwise.

Mr Cadell of Grange, while agreeing that Councillors should as far as possible be drawn from all parts of the country, pointed out that it might be difficult for men in outlying places to attend the meetings. He supported the motion because he thought it would have the effect of introducing new blood.

Mr Dods, Novar, and Mr Johnstone, Ayr, both suggested that some sort of local or district representation might be devised.

Sir John Stirling-Maxwell said that the motion had been

carefully prepared, and the Council thought that for the present at least it would be better that one-fifth only should retire annually rather than one-third as proposed by Mr France. It seemed to them that such an arrangement would provide for a good deal of fresh blood and allow members from different districts to come in.

Mr M'Hattie in his reply pointed out that the Aberdeen branch had the right to send a special member to the Council in addition to members who might otherwise be elected as representing their district.

The Chairman then put the amendment to the meeting, when seven members voted for it. He afterwards put the motion to the meeting, when a large majority of those present voted for it. The Chairman accordingly declared that the motion had been carried by the necessary majority and adopted by the meeting.

Sir John Stirling-Maxwell said: "As a member of the Advisory Committee to which Mr Sutherland referred, I should like to say that I and others, members of this Society, who belong to that Committee, recognise that in remaining as we have done on a Committee which has made so little progress on the objects which were in view when we joined, we feel we have incurred certain responsibilities, and I want to say that we recognise that the slow progress made has been disappointing; but, at the same time, we have remained on that Committee because we have perfect confidence in the work Mr Sutherland is doing, and in the support he is receiving from the Secretary for Scotland. Were it not for that we should not have remained on the Committee. I am very glad Mr Sutherland took the Society so much into his confidence, in regard to those matters which every one considers of the greatest moment. The reason so little progress has been made, I am perfectly certain does not lie in any want of effort on the part of Mr Sutherland or the Secretary for Scotland. The reason progress has not been made is partly due to the entanglement of Departments into which, through the unwisdom of Parliament, this whole subject has been plunged; partly to the fact that the whole control lies not with those who understand the business but with an outside body, the Development Commission; and also partly, I think, to the fact that those members of the Development Commission who are particularly dealing with forestry do not seem to be able to hold their own with their colleagues in such a way as to

keep that subject forward in the position to which it was certainly assigned by the Chancellor of the Exchequer when that Commission was first appointed. While in those major operations which require large sums of money there has been a standstill, in other matters progress has been made, and under Mr Sutherland's guidance the Department of which he is the head has become, and is becoming every month more and more of real value to forestry in Scotland. That Department has done a great deal of useful work within the last twelve months. Take, for instance, the Diamond Jubilee celebrations. We were immensely assisted by the fact that we received a sum of £150 from the Board of Agriculture towards the expenses of entertaining the foreign guests. Then a number of useful leaflets on the different subjects have been circulated. Then, too—Mr Sutherland spoke very modestly on the subject—the necessities of the war found his Department quite alive, and thanks to its intervention, an arrangement was made with the railways that must have made an immense difference in the bringing of pit-timber to pits from woods at a great distance, the rate being reduced to a maximum of 10s. during the war. He also took up the matter of the important by-product of potash salts. And then there is that step in advance, the appointment of Advisory Officers, which will make for every working forester who wishes to carry out his work on scientific lines a very great difference, and will open up a very great opportunity. In all those matters advance has been made, and therefore as one who has had more than once, in fact very often indeed, to pitch into Government Departments for their want of attention and want of sympathy, I should like if I might on this occasion say, that we all owe a great debt of gratitude to Mr Sutherland for the work he has been doing on our behalf during the last twelve months."

On the motion of Mr James Whitton, Glasgow, the Chairman received a cordial vote of thanks for presiding.

APPENDIX A.

ABSTRACT OF

DIAMOND JUBILEE TOUR AND ANNUAL EXCURSION ACCOUNTS,

Year 1914.

Balance from last year				£187	18 7
Less Auditor's Fee for 1913				2	2 0
				185	16 7

RECEIPTS.

Donation from Board of Agriculture	£150	0	0		
Donation from the Society	101	13	11		
Donation from Diamond Jubilee Home Guests	90	0	0		
Common Purse (Ordinary Members)	272	3	0		
				613	16 11
Interest				2	12 11
				802	6 5

PAYMENTS.

Preliminary Expenses	£9	6	6		
Motors	231	4	6		
Hotels	346	9	7		
Railways and Steamers	64	15	10		
Printing and Miscellaneous	95	14	11		
				747	11 4
Balance carried forward to next year				£54	15 1

consisting of—

1. Sum on Deposit Receipt of National Bank of Scotland, Ltd.	£50	0	0	
2. Sum at Credit of Account Current with Do.	1	6	9	
3. Sum in Treasurer's hands	3	8	4	
	£54	15	1	

EDINBURGH, *27th January* 1915.—Examined with Memorandum Book and Vouchers produced and found correct. The above Deposit Receipt and Bank Certificate of above balance on Current Account have been exhibited. The balance of £54, 15s. 1d. at credit as above to be resumed in next Account.

JOHN T. WATSON
Auditor.

APPENDIX B.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1914.

RECEIPTS.

Balance in Bank at close of last Account . .	£4 16 6
Income Tax recovered	0 3 6
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1914, £3, *less* Income Tax, 3s. 10d.	2 16 2
	£7 16 2

PAYMENTS.

Henderson & Bisset—account for binding books and periodicals .	£6 8 3	
John Bartholomew & Co. for British Isles Gazetteer . . .	0 15 0	
		£7 3 3
Balance carried forward, being sum in National Bank of Scotland on Account Current . . .		£0 12 11

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 19*th January* 1915.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,
Auditor.

for Annual Meeting, . . .			£24 11 8
Auditor, ...			3 3 0
Hon. Editor's Assistant, £30; and Authors of German French Notes for *Trans.*, £10; and assistance with Index, £1,			41 0 0
Secretary and Treasurer, including extra £35 for Diamond Jubilee Year, .			160 0 0
Advertising, Insurance, and Premium on Secretary's Bond of Caution, . .			4 19 11
Councillors' Railway Fares and Luncheons			13 7 3
Postages and Miscellaneous Outlays, viz.:			
Postages of Parts I. and II. of Vol. XXVIII. of *Transactions*, £40 10 0			
General Postages, Commissions on Cheques, and Petty Outlays, . .	34 13 1		
			75 3 1
			£322 4 11
9. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*, . .			199 18 8
Note.—Balance of Revenue as above, . .		£199 18 8	
Less Balance at debit of Capital as above,		5 8 9	
		£194 9 11	
Consisting of—			
Sum at credit of National Bank of Scotland, Ltd., .	£191 7 5		
Sum in Treasurer's hands, .	3 2 6		
		£194 9 11	
			£1000 16 11

£1000 16 11

EDINBURGH, 21*st January* 1915.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1914, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

APPENDIX C.

ABSTRACT OF ACCOUNTS for Year ending 31st December 1914.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1913,		£1659 15 4
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 94½,	£472 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 100⅝,	501 17 6	
£400 North British Railway Company 3 per cent. Debenture Stock, at 74⅜,	297 10 0	
£400 North British Railway Company, No. 1, 4 per cent. Preference Stock, at 97,	388 0 0	
	£1659 17 6	
Furniture, etc., in Society's Room,	40 0 0	
	£1699 17 6	
Less Balance at Debit of Capital,	5 8 9	
	£1659 15 4	
2. Life Members' Subscriptions in 1914,		181 6 0
New Members, £105 0 0		
Ordinary Members by commutation, 76 6 0		
		£1841 1 4

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£146 12 7
Unexhausted: £871 10 0 / 127 10 1		
⅞ of Full Life Subscriptions,	£123 9 4	
⅛ of Commuted Subscriptions,	23 3 3	
2. Funds, etc., at 31st December 1914, as valued at close of 1913—		
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 94½,	£472 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 100⅜,	501 17 6	
£400 North British Railway Company 3 per cent. Debenture Stock, at 74⅜,	297 10 0	
£400 North British Railway Company, No. 1, 4 ½ Preference Stock, at 97,	388 0 0	
	£1659 17 6	
Furniture, etc., in Society's Room, say,	40 0 0	
	£1699 17 6	
Less Balance at Debit of Capital,	5 8 9	
		1694 8 9
		£1841 1 4

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1913,		£343 17 10
2. Ordinary Members' Subscriptions,		396 3 0
Arrears at 31st December 1913, £20 9 6		
Add Arrears written off but since recovered, 0 16 0	£21 5 6	
Subscriptions for 1914, £493 12 6		
Less Received in 1913, 9 19 0	423 13 6	
Subscriptions for 1915 received in 1914,	3 18 6	
	£448 17 6	
Deduct—		
Cancelled or written off as irrecoverable at 31st December 1914, £12 10 6		
Arrears at 31st December 1914, 40 4 0	52 14 6	
	£396 3 0	
3. Proportion of Life Members' Subscriptions transferred from Capital,		146 12 7
4. Dividends and Interest,		68 8 7
5. *Transactions* and Reports sold,		6 17 2
6. Income Tax Recovered,		3 17 9
7. Donation from the Earl of Crawford to account of cost of Index to Transactions,		85 0 0
		£1000 16 11

DISCHARGE.

1. Printing, Stationery, etc.,		£273 12 1
Vol. XXVIII. Part 1. *Trans.*, £94 17 5		
Authors' Reprints, 2 13 3		
	£97 10 8	
Vol. XXVIII. Part II. of *Trans.*, including Index, £145 8 6		
Authors' Reprints, 2 18 9		
	148 7 3	
	£245 17 11	
General Printing and Stationery, £50 14 6		
Forestry Periodicals, Binding, etc., 3 17 2		
	54 11 8	
	£300 9 7	
Less Receipts for Advts. in *Trans.*,	26 17 6	
	£273 12 1	
2. Prizes (Money, £56, 10s.; Medals, £24, 17s. 6d.; Books, £5, 0s. 6d.),	£86 8 0	
Less Donation from the Highland and Agricultural Society, for Prizes awarded for Home-Grown Timber exhibited at Inverness,	20 0 0	
		66 8 0
3. Forestry Exhibition at the Highland and Agricultural Society's Show at Hawick—		
Printing,	£10 2 6	
Advertising,	2 0 0	
Incidental Expenses,	6 4 2	
		18 6 8
4. Nursery and Plantation Competition in Show District—		
Printing,	£5 1 6	
Judges' expenses,	9 0 2	
	£14 1 8	
Less Entry Money received,	5 3 6	
		8 18 2
5. Contribution to Aberdeen Branch,		5 0 0
6. Contribution to Diamond Jubilee Celebration Fund,		101 13 11
7. Fee to Reporter,		4 14 6
8. Expenses of Management,		322 4 11
Rent of Room and Taxes for 1914, and Hall for Annual Meeting,	£24 11 8	
Auditor,	3 3 0	
Hon. Editor's Assistant, £30; and Authors of German French Notes for *Trans.*, £10; and assistance with Index, £1,	41 0 0	
Secretary and Treasurer, including extra £35 for Diamond Jubilee Year,	160 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	4 19 11	
Councillors' Railway Fares and Luncheons	13 7 3	
Postages and Miscellaneous Outlays, viz.: Postages of Parts I. and II. of Vol. XXVIII. of *Transactions*, £40 10 0		
General Postages, Commissions on Cheques, and Petty Outlays, 34 18 1		
	75 3 1	
	£322 4 11	
9. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,		199 18 8
Note.—Balance of Revenue as above,	£199 18 8	
Less Balance at debit of Capital as above,	5 8 9	
	£194 9 11	
Consisting of—		
Sum at credit of National Bank of Scotland, Ltd., £191 7 5		
Sum in Treasurer's hands, 3 2 6		
	£194 9 11	
		£1000 16 11

EDINBURGH, 21st *January* 1915.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1914, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

25

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APPENDIX D.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1914.

The Committee beg to submit the Ninth Annual Report of the Branch.

The Membership of the Branch is 131, seven new members having joined the Branch during the year.

The Branch has lost several members through death and removal from the district, including Mr W. E. Nicol of Ballogie, and Mr W. J. Woodman-Smith of Laithers.

The four quarterly meetings of the Branch, fixed for 13th December 1913, and 9th May, 8th August, and 17th October 1914, were all held with the exception of the one on 8th August, on which date it was arranged to hold an excursion to Haddo House, but, on account of the outbreak of war, it had to be abandoned.

At the Annual Meeting held in December, Sir John Stirling-Maxwell, Bart. of Pollok, a former President of the Society, gave an address, the subject being "Planting of Moorlands," and, in the course of the address, he dealt specially with the approved method of planting on moss and peaty soils, and draining and ventilating the same for that purpose, giving the result of his own experience in planting this kind of soil. The address was of a most interesting nature, and the discussion on it which followed was taken part in by Sir John Fleming, and Messrs Gammell, Duthie, France, Leslie, and the Chairman, Mr A. F. Irvine. The meeting held in May took the form of an excursion to the paper mills of Messrs Thomas Tait & Sons, Ltd., at Inverurie, and to the woods of Keithhall, the property of the Right Honourable the Earl of Kintore. Much of interest was seen and discussed at both places, and especially at the Inverurie Mills, where the process by which wood is converted into pulp and afterwards manufactured into paper was seen and explained. This is believed to be the only mill in Scotland where the full process is carried out. At the meeting of the Branch in October, a paper was read by Mr Peter Leslie, M.A., B.Sc., Lecturer in Forestry at the University of Aberdeen, on the "Planting of Sand Dunes at Culbin," followed by an

interesting discussion on the subject of the paper, which was taken part in by the Chairman and several other members.

During the year a sub-committee was appointed by the Branch to lodge memorials with the North of Scotland College of Agriculture, and the County Committees on Secondary Education for Aberdeen, Banff and Kincardine, anent lectures and bursaries in connection with forestry. The memorials in all cases have been lodged and favourably received by all the Committees in question. The County Committees indicated that they were willing to do everything in their power to promote forestry and the objects aimed at in the memorials, but at the present time they had not adequate funds to warrant them inaugurating a scheme for the establishment of special bursaries. The Governors of the North of Scotland College of Agriculture pointed out that there was a difference at the present time between their Board and the Board of Agriculture in regard to the appointments which were necessary to fully equip the college in the matter of the teaching of forestry, but indicated that they were in favour of the scheme.

The Committee note with pleasure that this year the Society has attained the sixtieth anniversary of its institution, and that as a fitting recognition of the event the Society was honoured by the presence of many foreign foresters of note on the occasion of the celebration of the Society's Diamond Jubilee. As a Branch of the Society we, however, regret that Branches in their corporate capacity were not allowed any participation in these celebrations.

The Committee have again to record their thanks to Professor Trail and the University authorities for the use of the Botany class-rooms for the meetings of the Branch.

CHARLES S. FRANCE,
Vice-President.

ABERDEEN, *December* 1914.

APPENDIX E.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1914.

GENERAL ACCOUNT.

INCOME.		EXPENDITURE.	
Balance at credit of last Account	£8 7 6½	Printing, Advertising, etc.	£3 6 0
Subscription from Members at 1s.	6 2 0	Postages and Incidental Outlay	2 2 6
Savings Bank Interest	0 4 5	Honorarium to Secretary	3 3 0
Grant from Parent Society	5 0 0	Transferred to Excursion Account	1 0 0
		Balance at Credit at close of year	10 2 5½
	£19 13 11½		£19 13 11½

EXCURSION ACCOUNT.

Transferred from General Account	£1 0 0	Balance at Debit of last Account	£1 3 8
From Members	4 18 0	Lunch, Gordon Arms Hotel, Inverurie	3 17 0
Balance at Debit of Account	0 10 6	Printing, Postages and Incidental Expenses	1 7 10
	£6 8 6		£6 8 6

LIBRARY ACCOUNT.

Balance at Credit of last Account	£2 0 0	Postages and Incidents	£0 2 6
		Balance at Credit of Account	1 17 6
	£2 0 0		£2 0 0

ABSTRACT.

Balance at Credit of General Account	£10 2 5½
Balance at Credit of Library Account	1 17 6
	11 19 11½
Balance at Debit of Excursion Account	0 10 6
Balance at Credit of Branch per Savings Bank Pass Book No. 393	£11 9 5½

Aberdeen, *8th December* 1914.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and find the same properly stated and vouched, the balance at the credit of the Branch being Eleven pounds nine shillings and fivepence halfpenny, which sum is deposited with the Aberdeen Savings Bank, per Savings Bank Book, No. 393, which I have also seen.

Wm. WYLLIE.

APPENDIX F.

Office-Bearers for 1915:—

PATRON.

His Majesty The King.

PRESIDENT.

Colonel Archibald Stirling of Keir, Dunblane.

VICE-PRESIDENTS.

Sir Andrew Agnew, Bart. of Lochnaw, 10 Smith Square, Westminster.
Colonel W. Steuart Fothringham of Murthly, Perthshire.
Sydney J. Gammell of Drumtochty, Countesswells House, Bieldside, Aberdeen.
John F. Annand, M.Sc., Adviser in Forestry, Armstrong College, Newcastle-upon-Tyne.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
Chas. Buchanan, Factor, Penicuik Estate, Penicuik.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh
Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

Adam Spiers, Timber Merchant, Warriston Saw-Mills, Edinburgh.
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Robert Forbes, Overseer, Kennet Estate Office, Alloa.
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W. M. Price, Factor, Minto, Hawick.
Geo. Leven, Forester, Bowmont Forest, Roxburgh.
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John Broom, Wood Merchant, Bathgate.
Alexander Murray, Forester, Kingswood, Murthly.
J. H. Milne Home, Irvine House, Canonbie.
Thomas Bryden, Dennison Nursery, Ayr.
John A. Howe, Sharpdale, Old Dalkeith Road, Edinburgh.
G. P. Gordon, B.Sc., Advisory Forest Officer, West of Scotland Agricultural College, 204 Bath Street, Glasgow.
James Whitton, Superintendent of City Parks, City Chambers, Glasgow.
A. D. Richardson, 6 Dalkeith Street, Joppa.
Brig.-General The Lord Lovat, K.T., D.S.O., Beaufort Castle, Beauly.
Frank Scott, Forester, Jeanie Bank, near Perth.
The Earl of Crawford and Balcarres, Balcarres, Fife.
James Grant, Forester, Raith, Kirkcaldy.
Extra Member—President of Aberdeen Branch (Professor Trail).

HON. EDITOR.

Dr A. W. Borthwick, 46 George Square, Edinburgh.

AUDITOR.

John T. Watson, 16 St Andrew Square, Edinburgh.

HON. SECRETARY.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 19 Castle Street, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Professor Bayley Balfour, Royal Botanic Garden, Edinburgh.

Chemist—Dr Alexander Lauder, F.I.C., 13 George Square, Edinburgh.

Cryptogamist—Dr A. W. Borthwick, 46 George Square, Edinburgh.

Entomologist—Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh.

Geologist—Dr R. Campbell, Geological Laboratory, University of Edinburgh.

Meteorologist—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

The Right Hon. Sir Ronald C. Munro Ferguson, K.C.M.G., W. Steuart Fothringham of Murthly, and Sir John Stirling-Maxwell, Bart. of Pollok.

LOCAL BRANCHES.

Aberdeen.

President.—Prof. Trail, Aberdeen University.

Hon. Secretary.—George D. Massie, Advocate, 147 Union Street, Aberdeen.

Northern.

President.—Brodie of Brodie.

Hon. Secretary.—Alex. Fraser, Solicitor, 63 Church Street, Inverness.

CORRESPONDENTS RESIDING ABROAD.

The following have agreed to act as Correspondents residing abroad :—

Canada, . Robert Bell, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa, late Chief Geologist to Government of Canada, Ottawa.

India, . . F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.

British East Africa, . } Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, } Hugh P. Baker, Dean, New York State College of Forestry, Syracuse, N.Y.

Cape Colony, . W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.

New Zealand . R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago.

South Africa . K. A. Carlson, Orange Free State Conservancy.

PHOTOGRAPHIC ARTIST.

A. D. Richardson 6 Dalkeith Street, Joppa.

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Counties.	
	Scotland.
Aberdeen,	John Clark, Forester, Haddo House, Aberdeen.
	John Michie, M.V.O., Factor, Balmoral, Ballater.
Argyll,	H. L. Macdonald of Dunach, Oban.
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	A. B. Robertson, Forester, The Dean, Kilmarnock.
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Bute,	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, retired Forester, Barone, Rothesay.
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	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	James A. Gossip, Nurseryman, Inverness.
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Derby,	S. MacBean, Estate Office, Needwood Forest, Sudbury.
Devon,	James Barrie, Forester, Stevenstone Estate, Torrington.
Durham,	John F. Annand, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
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Herts,	Thomas Smith, Overseer, Tring Park, Wigginton, Tring.
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Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
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	Ireland.
Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture.
	ARCH. E. MOERAN, Lissadell, Stillorgan Park.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	ALEX. M'RAE, Forester, Dundrum.

APPENDIX G.

Presentations to the Library since the publication of the List in Volume XXVIII. Part 2.

Books.

1. Boutcher's *Treatise on Forest Trees*, 1775. By John M'Laren.
2. Gregor's *Arboriculture*, 1881. ,,
3. *Report of the Society's Excursion to Balmoral*, 1887. ,,
4. *Transactions of Highland and Agricultural Society*, 5 series, vol. 26, 1914.
5. *Journal of Royal Agricultural Society of England*, vol. 74, 1913.
6. *Report of Smithsonian Institution*, 1912.
7. Canada. Commission of Conservation :—
   (1) *Fourth Annual Report.*
   (2) *Forest Protection*, 1912.
   (3) *Trent Watershed Survey*, 1913.
   (4) *Long Sault Rapids, St Lawrence River*, 1913.
   (5) *Coal in Canada*, 1914.
8. ,, Department of Agriculture:—*Fodder and Pasture Plants.* By G. U. Clark and M. Oscar Malte.
9. *Hardy Trees and Shrubs in the British Isles.* By W. J. Bean.
10. *Trees: A Woodland Notebook containing Observations on certain British and Exotic Trees.* By the Right Hon. Sir Herbert Maxwell, Bt., D.C.L., etc.

Government and State Reports.

11. Scotland :—*Second Report of the Board of Agriculture*, 1913.
12. England :—
    (1) *Ninety-Second Report of Commissioners of H.M. Woods, Forests, etc.*, June 1914.
    (2) *Joint Annual Report of Forestry Branches of the Board of Agriculture, etc., and Office of Woods, etc.*
13. Ireland :—
    (1) *Scientific Proceedings of Royal Dublin Society*, vol. xiv., Nos. 9-23.
    (2) *Economic* ,, ,, vol. ii., Nos. 7, 8, 9.
14. India. Forest Bulletins :—
    (1) No. 23. *Note on Preparation of Indian Forest Floras and Descriptive Lists.* By R. S. Hole, F.C.H., etc.
    (2) No. 24. *Note on Turpentines of* Pinus Khasya, P. Merkusii *and* P. excelsa. By Roran Singh.
    (3) No. 25. *Development of the Culms of Grasses.* By R. S. Hole.
    (4) No. 26. *The Resin Industry in Kumaon.* By E. A. Smythies, I.F.S.
15. Indian Forest Records :—
    (1) *Œcology of Sal*, Part I. By R. S. Hole, F.C.H., etc.
    (2) *Report of Madras Forest Department*, 1912-13.
    (3) *Statistics relating to Forest Administration in British India.* 1912-13.

16. Indian Forest Memoirs :—*Report on Forest Administration*, 1913.
17. Australia :—*Report of Forestry Branch, Brisbane*, 1913.
18. Union of South Africa. Bulletins of Forest Department :—
    (1) No. 5. *Forestry in relation to Irrigation in South Africa.* By K. A. Carlson.
    (2) No 6. *Forestry in the Free State.* By K. A. Carlson.
    (3) No. 7. *Windbreaks for the Dry Farm.* ,,
19. New Zealand :—
    (1) *Report on State Nurseries and Plantations*, 1913-14.
    (2) *Report on Department of Lands and Survey*, ,,
    (3) *Report on Survey Operations*, ,,
20. Canada. Forestry Branch :—
    (1) *Report of the Director of Forestry*, 1913.
    (2) Forest Products, 1911 :—
        Poles and Cross-Ties (measured). Bulletin No. 35.
    (3) *Timber Conditions in Little Smoke River Valley, Alta., and adjacent Territory.* Bulletin No. 41.
        Co-operative Forest Fire Protection. Bulletin No. 42.
        Wood-using Industries of the Maritime Provinces. No. 44.
        Manitoba a Forest Province. Circular No. 7.
        The Forest Products Laboratories. ,, No. 8.
        Chemical Methods for Utilising Wood Wastes. ,, No. 9.
        The Care of the Woodlot. ,, No. 10.
        Regulations for Dominion Forest Reserves.
21. United States of America :—
    (1) Forest Service Leaflets and Circulars.
    (2) ,, Bulletin No 101. *Relative Resistance of Various Conifers to Injection with Creosote.*
    (3) *Density of Wood Substance and Porosity of Wood.* A reprint.
    (4) University of California. *Eucalyptus in California.* Bulletin No. 196.
    (5) New York State College of Forestry. Bulletins :—
        The State Ranger School.
        Rural and City Shade Tree Improvement.
        State Forest Camp in the Adirondacks.
        The Reforestation of Cut over and Idle Lands in New York.
        Wood-using Industries in New York.
        Possibilities of Municipal Forestry in New York.
    (6) Department of Forestry. Pennsylvania. Bulletin No. 11, June 1914. *Pennsylvania Trees.*

Societies' and Institutions' Reports and Transactions.

22. England :—
    (1) Cambridge University. *Report of Library Syndicate*, 1913.
    (2) Association of Economic Biologists. *Annals of Applied Biology*, vol. i., Nos. 1-4.

23. Scotland :—
    (1) *Transactions of the Perthshire Society of Natural Science*, vol v., 1909 to 1914, vol. vi., 1913-14, part 1.
    (2) *Transactions of the Botanical Society of Edinburgh*, vol. xxvi., part 3, 1913-14.
    (3) Natural History Society of Glasgow :—*The Glasgow Naturalist*, vol. vi., Nos. 2, 3 and 4.
    (4) Royal Botanic Garden, Edinburgh :—*Notes from November* 1913, vol. viii., No. 37.

Reprints and Miscellaneous.

24. *Observations on some London Trees.* By Hugh Boyd Watt.
25. *Note on Douglas Fir Plantation, Llandinam, Montgomeryshire.* By Professor Fraser Story.
26. *Forestry and the War.* By Sir William Schlich, K.C.I.E.
27. *Skogsaken.* By Alex. Heiberg, Lysaker.
28. Leaflets of the Board of Agriculture.
29. Copies of recent *Transactions*, and a number of Pamphlets, Reprints, Photographs, Negatives and Lantern Slides from the Representatives of the late Colonel Bailey.
30. *The Estate Magazine.*
31. *L'Alpe.* Bologna.
32. *Tidskrift for Skogbrug.* Kristinia.
33. *Skogsvårdsföreningens Tidskrift.* Stockholm.
34. *The Indian Forester.*
35. *Forestry Quarterly.* New York.
36. *Quarterly Journal of Forestry.* London.
37. *Canadian Forestry Journal.*
38. *American Forestry.*
39. *Timber Trades Journal.*
40. *Timber News.*
41. *Revue des Eaux et Forêts.* Paris. (By purchase.)
42. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)
43. *Allgemeine Forst- und Jagd-Zeitung.* (By purchase.)
44. *Zeitschrift für Forst- und Jagdwesen.* (,,)

TRANSACTIONS

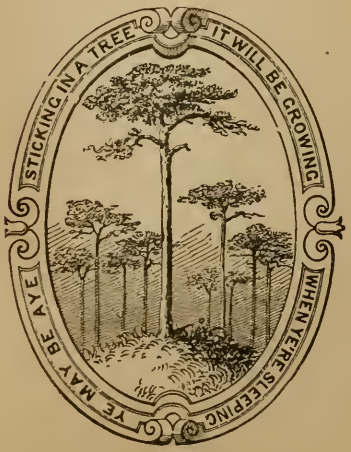
OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXX.



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1916.

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The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

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Reviews and Notices of Books:—The Artistic Anatomy of Trees: Their Structure and Treatment in Painting. By Rex Vicat Cole. Illustrated by 50 examples of pictures from the time of the early Italian artists to the present day, and 165 drawings by the author, supplemented by 300 diagrams in the text. xv+347 pp. Price 7s. 6d. net. London: Seeley, Service & Co., 1916 . . . 66

Insects and Man. An account of the more important, harmful and beneficial insects, their habits and life-histories, being an introduction to Economic Entomology for students and general readers. Illustrated with drawings and reproductions from photographs. By C. A Ealand, M.A. Price 12s. London: Grant Richards, Ltd., 1915 67

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXX.—PART I.

January 1916.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
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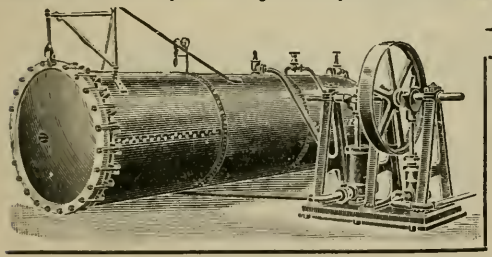

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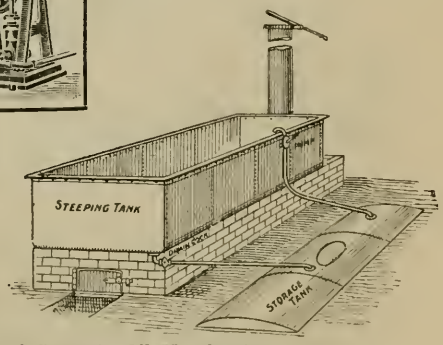

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. Two Forest Arboretums near Brussels.

By D. E. Hutchins.

In the summer of 1913, while visiting the magnificent suburban forest of Soigne, at the gates of Brussels, I spent some time in the two Government arboretums which it contains. They are both "group" arboretums, not single tree arboretums, so that they represent forest conditions.

The following notes regarding the growth of trees in them may perhaps be of interest to British foresters. It will be many years before similar results can be obtained in Britain; and in any case, these Belgian trees have got a start of a quarter of a century while British State Forestry in the mossy island has slept its deadly sleep! These two arboretums near Brussels have the special advantage, to Britons, of being in a climate differing but slightly from that of the south-east of England. From Dover to Brussels is but 140 miles as the crow flies, and the warm westerly winds sweep on to Belgium with the same maritime effect which we experience in England.

Belgians insist upon the essentially maritime character of their climate, as far as a good deal south of Brussels. This, of course, is not to say that the climate of Brussels does not differ slightly from the climate of Kent. The summer heat at Brussels is a few degrees higher; skating in winter is more certain than in England, and there are trees which succeed fairly well in parts of Britain and Ireland, but fail in Belgium. An example is the tree which I have long considered the finest and most valuable on this globe, *Sequoia sempervirens;* many of the heavy rainfall Japanese trees also, which, though feeling the lack of sun-power, get along fairly in the British Isles, have bad spells in Belgium from drought. Douglas too fears drought in parts of Belgium. But, after all, this difference is

small; and this is certain, that while we have no systematically-arranged oldish arboretums in England reproducing close forest conditions, these two, in the forest of Soigne, are those which, on the Continent, are nearest to us and most instructive for us.

It should be noted that sentiment, which is so strong in favour of indigenous trees in France and Germany, is in Belgium rather in favour of exotics. Bommer and Comte Visart, in their excellent text-book of Belgian exotics, lay down very clearly what exotics have to do in Belgium before they can hope to oust the indigenous trees; and I think there is no fear of the practical common sense of the matter being exceeded in Belgium. It must be remembered that South African forestry depends mainly on exotics; Australian forestry must do the same to a great extent; and possibly New Zealand to a larger extent. The question is mainly one of geographical history and geographical accident.

Bommer gives the following list of the most important foreign species now growing well in Belgium :—

Populus canadensis.
Quercus rubra.
Robinia pseudacacia.
Juglans nigra.
Picea excelsa (not now found wild in Belgium).
Larix europæa.
Pinus Laricio.
Pinus Laricio var. austriaca.
Pinus Strobus.
Pseudotsuga Douglasii.
Abies alba (pectinata) (not now found wild in Belgium).

And the following list of foreign species most worthy of experimental forest cultivation in Belgium :—

Betula lenta.
Betula lutea.
Carya alba.
Carya amara.
Quercus tinctoria.
Prunus serotina.
Fraxinus alba.
Fraxinus nigra.
Abies Nordmanniana.
Abies nobilis.
Picea sitchensis.
Picea orientalis.
Thuja gigantea (plicata).
Tsuga Mertensiana.
Chamæcyparis (Cupressus) Lawsoniana.
Pinus contorta var. Murrayana.

To this list M. Drion would add *Libocedrus decurrens* and *Abies concolor* var. *Lowiana*.

When in the larger of the two arboretums, I was so fortunate as to meet M. Drion of Brussels, who, most kindly, has looked through my MS., checked a number of the measurements, and given me notes regarding the growth of various trees in Belgium which are incorporated here. The diameters are measured, at 5 feet above the ground, to the nearest inch; the heights are estimated. In a few of the plots there may be a little loss of growth from a too long deferred thinning in the case of certain light-demanding species, but this is rare. There is also lost growth in a few cases with species that have special soil proclivities. Thus black Austrian pine does not get in the forest of Soigne the lime it wants. This is referred to in the note on its growth.

The soil in both the arboretums is a good average loam; running into blackish meadow loam in the lower part of the Tervueren arboretum. The rainfall is 28 inches: the elevation not enough to effect the climate. All the arboretum plots are grown close and kept under normal forest conditions. It will be noted that most of the plots of trees in those two arboretums range between 15 and 30 years of age. The ages given here are from seed. In the Groenendaal arboretum *Picea sitchensis*, *Chamæcyparis pisifera*, *Picea Schrenkiana*, and many Japanese conifers suffered severely from the drought of 1911.

In cases where only two figures are mentioned, as 7 × 34, the meaning is 7 inches of average diameter at 5 feet above the ground level, and 34 feet total height.

Douglas fir is the fastest-growing conifer in both arboretums, and averages about half an inch diameter and 2–3 feet height-growth per year.

In certain places in this list, there are two references to the same tree. That refers to two plots in the arboretum where there is some striking difference of growth or other point that seemed worthy of note.

Groenendaal Arboretum.

Larix leptolepis (Japanese larch). At 15 years old is about 5 inches diameter by 30 feet high, and at 22 years 7 inches by 34 feet. It compares very favourably with the European larch, but M. Drion considered that the latter here is not a fair sample. He adds that the Japanese larch in Belgium suffered badly from the dry summer of 1911: trees 20 and 25 feet high were killed

out. As compared with the European, the Japanese larch here is of a decidedly lighter green and has a rougher bark.

Larix occidentalis. A failure.

Larix sibirica. A failure: suffers like so many other continental species from spring frosts.

Pseudotsuga Douglasii, Douglas (var. *glauca* or Colorado variety). Quite healthy-looking with a fine dense covert; in growth between the two larches; it is 19 years old against the 15 years of the Japanese larch. So that here Japanese larch has beaten the "*glauca*" Douglas easily, in rapidity of growth.

Quercus macrocarpa. Almost one of the best trees in the arboretum. It runs up with good straight stems and a dense covert. At 19 years averages 3 inches diameter by 18 feet high.

Quercus tinctoria. One of the best oaks in the good collection of oaks here. At 18 years, 3 inches by 23 feet high. This I may add is one of the best oaks in the fine collection of the Melbourne Botanic Garden.

Quercus tinctoria var. *macrophyllum.* This looks even better. It shows good growth and is of a handsome appearance with its big dark-green leaves. At 20 years it averages 3 inches diameter by 37 feet high, and shows a vigorous even growth.

Quercus palustris. At 21 years it averages 4 inches diameter by 40 feet high. In the fine collection of oaks here it is only surpassed by *Quercus rubra.* It is one of the best of the American oaks.

Quercus rubra. Easily the best in growth of all the oaks here. Average, 7 inches diameter by 32 feet high at 27 years of age. Maximum, 10 inches diameter by 55 feet high. The average diameter strikes the eye as 30 per cent. and the height 25 per cent. above that of *Quercus sessiliflora* alongside, this being 20 years old, or 7 years younger than the *Quercus rubra.*

Quercus rubra grows very well generally in Belgium, in damp soil, says M. Drion, but fails elsewhere. Shoots like a poplar, he adds, in favourable soil, viz. plateaux with fertile soil and the edge of water-courses and marshes. At Rawenstein, near Quatre-Bras close to Brussels, is a hectare planted pure with *Quercus rubra* and doing well. I saw quite a show of timber specimens of *Quercus rubra* at the Ghent Exhibition, and there were photographs of oaks cubing $4\frac{1}{2}$ cubic metres.

Quercus sessiliflora. Is of exactly the type I noted in the forest of Soigne, generally. There is a good description of this

in the excellent arboretum pamphlet. At 20 years these trees average 4 inches diameter by 26 feet high.

Quercus pedunculata. The same timber growth as *Quercus sessiliflora*, but not the same clear stems nor good covert. The foliage is sparser than *Quercus sessiliflora*, and the growth somewhat less.

Quercus pedunculata var. "*Chene de Juin.*" At 17 years the average diameter of non-dominated stems is 3 inches and the height 16 feet. Thus this late-leafing variety shows no advantage in growth here over the common oak.

Castanea vesca. Shows an uneven growth. At 15 years, maximum 5 inches diameter by 22 feet high, down to trees of all sizes. In Belgium, says M. Drion, it does best as copse. As in Kent, timber trees are liable to disease and rot at the heart. It is liable too when young to suffer from cold and spring frosts. 8-year-old chestnut copse sells in Belgium up to £16 the acre.

Robinias. There is a good collection of various species and varieties of *Robinia* here. They make a remarkable show with a growth about equal to the common oaks. This is the best collection of *Robinias* I have seen anywhere, not excepting those at Kew. M. Drion says that it pays to plant this tree in Belgium, while oak now does not pay—the private tree-grower.

Robinia pseudacacia var. *Bessoniana.* At 21 years, averages for dominating stems 6 inches diameter. *Robinia pseudacacia* at 18 years, 5 inches diameter. This result is not so good as one might expect generally in Belgium.

Larix leptolepis. A larger plot at 20 years old, has trees averaging 4 inches or 5 inches diameter by 45 feet or 50 feet high, and showing a grand growth with no apparent disease. It thus averages between 2 feet and 2½ feet height-growth per year. The best stems would now furnish telegraph poles. For its tenderness to drought, see above.

Picea sitchensis. Sitka spruce shows a good regular growth but has had a leaf disease for the last two years, and is now far from having the vigorous look of the common spruce. It certainly does not look so well, nor has it nearly so good a covert as *Picea excelsa* (the common spruce) adjoining it. At 22 years it averages 5 inches diameter by 30 feet high at one end of the plot, and 4 inches by 18 feet at the other: barely 1 foot per year height-growth.

Pinus Thunbergii. Shows a sturdy though somewhat stunted

growth; different to its luxuriant growth in the wetter parts of South Africa.

Cupressus Lawsoniana. At 20 years of age the best trees average 7 inches diameter and 33 feet high: mean 6 inches by 30 feet; an excellent-looking growth, but with a tendency to bifurcate. Is being tried as a forest tree: the Belgian Government has several trial plots of this species in the forest of Hertogenvald. It is said to do best in Belgium in damp situations.

Cupressus Nutkaensis. Does not average half the growth of *C. Lawsoniana.*

Thujopsis dolabrata. Again only about half of the last species: a failure as a forest tree.

Thuja occidentalis. Poor growth.

Acer rubrum. At 15 years, stem 15 feet high only. The fine autumn tints are now (September 24th) in full show. It is worth planting for its autumn tints.

Cupressus pisifera. A handsome tree; but at 19 years shows but a poor growth. Like other Japanese trees the growth in Belgium is uncertain.

Cryptomeria japonica. Of no use in Belgium (Comte Visart et Bommer) as a forest tree, but those here look fairly well. All the Japanese trees are liable to suffer from drought in Belgium. At 20 years the growth here is only 18 feet high. In 1880 many of the *Cryptomerias* in Belgium were killed by frost.

Acer platanoides var. *purpurea.* This shows some good colouring now.

Sequoia sempervirens. One poor specimen here out of ten planted, and this is one of the few in Belgium, says M. Drion. It will scarcely grow at all out of doors in Belgium. I presume the South of England marks the extreme limit of its climatic habitat on the cold damp soil.

Sequoia gigantea. Looks well here. It grows well in various places in Belgium where sheltered from the east wind, says M. Drion. There are some fine samples of this tree in Belgium.

Cedrus Deodara. Good young trees. All the old trees in Belgium, says M. Drion, perished in the severe winter of 1880. They are now planting them again in Belgium. Those here look quite well.

Liriodendron tulipifera. Looks well here and does well enough generally in Belgium, says M. Drion; to be tried as a forest tree.

Libocedrus decurrens. At 16 years has a maximum growth in this plot of 8 inches diameter by 30 feet high; a tree that seems hardy and well worth more extended planting in Belgium. It grows with the aspect of a very vigorous churchyard cypress (*Cupressus sempervirens*) in the sub-tropics: and seemingly, may be planted very close. It is less a tree of a temperate than of a sub-tropical climate, and I was surprised to see it doing so well here. It looked as well as the trees I saw in the Villa Borghese at Rome. M. Drion says that in the Parc Royal d'Ardenne are trees that at 30-40 years have diameters up to 20 inches, and heights of 46 feet.

Thuja gigantea. Is growing well here, as it generally does in Belgium, says M. Drion.

Picea Omorica of Servia. Looking very well: it seems quite worthy of trial in Belgium against the common spruce, says M. Drion.

Pinus Pinaster. This, it will be remembered, is the pine which has been more planted, and has spread more rapidly, than any other pine (or than any other tree) in South Africa. In the arboretum plot here, cluster-pine at 16 years of age runs about 3 inches diameter, and in height the trees are growing with strong leading shoots like spruce. At 20 years the average diameter of dominating trees is 5 inches. The Leiria (Portugal) tables give 4 inches by 39 feet as the normal for cluster-pine at age 20 years. These trees look better than any I have seen in England; but they have a stunted look compared to the cluster-pine in South Africa, and a lower rate of growth. They suffered badly from the snow this spring (1913), and bad winters, like that of 1879, almost wiped out the cluster-pine in Belgium and the centre of France. Nevertheless it is considered that cluster-pine is worth planting on the Belgian dunes as a temporary nurse for other species. M. Drion is much in favour of planting cluster-pine near the coast. It does quite well, he says, near the sea in Belgium.

Pinus Strobus. These trees show splendid covert and a clean soil, but many of them are yellow with a leaf disease. Growth now very regular and good. At 20 years the tree averages 5 inches diameter by 25 feet high.

Abies Nordmanniana. From the Caucasus. The growth of this tree is one of the best among the conifers here. It is about the same age as the common silver fir below and shows a better

growth, while two or three of the trees run 5 inches diameter by 31 feet high. The official catalogue of the arboretum has much to say in favour of this silver fir as compared with the common silver fir. Its appearance is more ornamental, its growth more vigorous, and it suffers less from spring frosts. There are some fine specimens of this tree in the Ardennes. Does well generally in Belgium, says M. Drion, especially at the Parc Royal d'Ardenne where there is a good natural reproduction. I may add that in Australia (from whence I am despatching these notes) it shows a beautiful growth in the cooler parts of the country, *e.g.* in the mountains of Victoria and Tasmania.

Abies pectinata. The common silver fir. [*Abies alba* (after Engler) is the more correct botanical name which is happily coming into use: appropriate not only in describing the silvery leaves, but the whiteness of the bark in the forest, the only distinction, at a distance, from the spruce.] Our old friend of the Black Forest and the glory of the Apennines gives one the impression of being one of the most vigorous-growing and healthy conifers here. At 22 years the average growth, however, is only 3 inches diameter by 18 feet total height, or perhaps less; and further, the growth is uneven and difficult to estimate. It is sending up strong leading shoots now.

Abies Pinsapo. A failure here. Does well in the Ardennes, says M. Drion. It grows well too in Tasmania, and as a planted tree on the mountains of Southern Spain, far from its present natural habitat there.

Pseudotsuga (*Abietia*) *Douglasii.* Oregon Douglas fir. *This is easily the best among all the conifers here for healthy and rapid growth.* At 23 years it averages in this plot, which is one of the worst, 5 inches diameter (with maximum of 7 inches) by 33 feet high (with maximum of 43 feet). M. Drion cites another plot of Douglas, which, at 19 years of age, with a somewhat irregular growth, had (on the stems which were not dominated) an average growth of $5\frac{1}{2}$ inches diameter; heights about 26 feet. He cites also the dictum of Crahay (the head of the Belgian Forest Department), that Douglas fir should not, in Belgium be planted in dry, hot localities. Another plot, 25 years old, has trees which are now 14 inches by 70 feet high, or an average height-growth of nearly 3 feet per year.

Quercus rubra var. *Texana.* The trees here average 11 feet high at 12 years of age, and have a vigorous look. They take a

very fine colour in autumn, said the forest guard who had been deputed to go round the arboretum with me. This seems a case of a sub-tropical tree growing well in a cold temperate climate, like *Cupressus macrocarpa*, *Pinus insignis*, and some others.

Quercus cerris. At 19 years, average 4 inches diameter by 30 feet high, and shows a first-rate growth.

Picea sitchensis. Sitka spruce. Has been failing here since the drought of 1911.

Picea Omorica, from Bosnia and Montenegro. Shows a quite good growth and a handsome appearance, the leaves glistening white in the sun.

Picea alba. White spruce of America. Grows vigorously here, more especially when young. The catalogue says that the growth of the three American spruces—white, black and red—are all good at Groenendaal ; but this is questioned by M. Drion.

Pinus contorta var. *Murrayana.* Very rapid growing. The forest guard with me here says he has seen leading shoots one metre in length on these trees. It is only the *Murrayana* variety that shoots up so well, says the forest guard. At 14 years it now averages 4 inches diameter by 26 feet high. This is somewhere near two-thirds the growth of Douglas. In this connection, I may mention that the Murray pine is the straightest and nearly the tallest conifer in a small pinetum here at Hobart, Tasmania.

Pinus Laricio var. *austriaca.* Austrian pine. Not doing well at Groenendaal ; wants lime. But *P. Laricio* var. *corsicana* shows a better growth ; also *P. Laricio* var. *calabrica.* M. Drion notes that the Corsican *Laricio* would show a better growth here, but has been left too long unthinned. A plot here at 16 years of age shows (in the trees not dominated) average diameters of 5 inches and heights of 23 feet, and similarly a plot at 23 years 7 inches diameter. The Corsican *Laricio* is valued in Belgium as being straighter and faster-growing than Scots pine, and hardier as regards soil, insect and fungoid pests : but so far it has not ousted the Scots pine, because it is more difficult to transplant, and the timber has not the same assured value. He cites a small plot at Roosveld (near Thouront), which, at 66 years of age, had a mean height of over 83 feet and diameters varying from 10 inches to 30 inches.

Fraxinus excelsior. At 18 years the plot averages 4 inches diameter by 36 feet high—all well grown.

Fraxinus americana. Same age and rather larger than the common ash, but not so straight. Bommer sums up European practice with the opinion that among all the American ashes that have now been tried for many years in Europe, only *F. americana* is really equal in all respects to *F. excelsior.*

Fagus sylvatica var. *purpurea.* At 32 years averages only 6 inches diameter by 30 feet high. But, says the forest guard, two things have held these trees back—(1) the purple variety grows rather more slowly than the other; (2) it has been planted far too sparsely for beech. In any case the beech always grows slowly at first.

Fraxinus juglandifolia. Same age. Growth a good deal inferior to the common ash.

Fraxinus oregona. Same age and about two-thirds the growth of the common ash (*F. excelsior*).

Juglans nigra. The big tree near the old castle, still in full vigour, measures 26 or 28 inches diameter with 30 feet bole and 88 or 90 feet total height. This fine old tree is one of the sights of the neighbourhood: age unknown. It is close to the arboretum, which is the reason for my mentioning it here. There are one or two similar great trees of *Juglans nigra* in the Botanic Garden at Brussels.

Arboretum at Tervueren.

This, the second and smaller of the two arboretums in the forest of Soigne, is, at the express wish of the late King of the Belgians, arranged geographically. Thus the trees of the Pacific slope are in one place, of N.E. America in another place, of Japan in another place: and so on for all the trees in the world that are climatically suited to the climate of Brussels. The collection is not yet complete. More funds are required both to complete it and to label it. It occupies two sides of a valley, and consideration of landscape beauty have entered into the grouping and arrangement of the trees.

This arboretum is at some distance from Groenendaal, and is reached by quite another route from Brussels. It has no labels, so that the visitor cannot do much without a guide. On this occasion, I had the good fortune to be accompanied by M. C. Bommer, the maker and caretaker of the arboretum. M. Bommer is the head of the Botanic Garden in Brussels, and

the author of two useful works on trees—(1) The Arboretum Cataloge of the Tervueren Arboretum, a well got-up bound work of 211 pages; (2) a large classic on the exotics of Belgium : one of the best and most complete works on mid-European exotics. The following are the chief trees we saw in our walk round the arboretum :—

Pinus contorta. Grows well here.

Picea sitchensis. Sitka spruce. The largest and one of the most quick-growing of the spruces: the most northern of the Pacific conifers, says the arboretum hand-book. This is well represented in the arboretum. Has here got the same leaf disease I saw at Groenendaal. Before this they grew very well, with yearly shoots up to 3 feet in length. Trees up to 3 feet in diameter exist in Belgium.

Picea rubra. Doing well here. Planted in the forest it seems neither better nor worse than the common spruce, says my guide, M. Bommer. But M. Drion cites 4 acres of *P. rubra* in the forest of Hertogenvald where the growth is only half that of the common spruce.

Tsuga Mertensiana. At 11 years, 20 feet high and up to 8 inches in diameter; very healthy. Handsome trees with thin nodding tops, but M. Bommer fears it may be too dry for them eventually. Rainfall 28 inches here, which is rather above the average rainfall in the south-east of England. In growth, up to now, they are close on Douglas fir which is the fastest-growing tree in the Tervueren arboretum. In this arboretum they have been planted, not only in their own group, but mixed with other groups for forest purposes on account of their good growth and handsome appearance.

Tsuga Pattoniana. A slow-grower from the Pacific mountains.

Pinus contorta var. *Murrayana.* A quick-growing tree with important forest qualities. This tree ranks very high in Belgium among exotics on account of the rapidity of its growth, its hardiness, and good natural reproduction. It will grow on all sorts of soil and has a wide natural habitat on the Pacific slope of North America. See note on its good growth in the Groenendaal arboretum.

Pseudotsuga Douglassii. Douglas fir. As at Groenendaal this is the fastest-growing conifer. At 17 years (from seed) the largest trees are some 12 inches in diameter and 40 feet high. About 9 inches diameter by 24 feet high is the average size.

Fagus ferruginea. From North America. It makes large forests there, but has not the importance of *Fagus sylvatica* in Europe, says M. Bommer. There is also a southern form which might be useful for sub-tropical work.

Betula pubescens. Birch. Very striking, with its pure white bark in the waning light of this fine autumn afternoon. The white rubs off like whitewash.

Betula excelsa. With better timber than the European birch: growing well here. It should have a forest value, says M. Bommer.

Cornus florida. An underwood tree from North America with foliage striped red and green: the flower, says M. Bommer, is splendid.

Platanus occidentalis. The true tree from America: certified by Dode, the French plane specialist, says M. Bommer. This does away with the statement that the true *P. occidentalis* will not survive in northern Europe. No doubt it is scarce. M. Bommer cites three good trees at Plantières near Metz. But for all practical purposes it is useless in northern and mid-Europe. (*Belgian Exotics*, p. 111).

Carya sulcata. Looks well. At 8 years is 18 feet high: a fine yellow colour now. Its great pinnate leaves recall the *Caryas* at Kew. *Carya tomentosa* had the best autumn tints this year among the Kew hickories.

Carya alba. With huge leaflets now all yellow and brown; shows fine autumn tints. But at 13 years from seed is only 2 inches in diameter by 15 feet high. I cannot compare this slow growth with the Kew trees, as the ages of the latter are not stated. It is a general defect, in nearly all the Kew labels, that the age of the trees is left out: the only defect in the model labelling at Kew.

Acer rubrum. Now ablaze with all its fiery autumn tints. Some years, says M. Bommer, it is more brilliant. This (1913) autumn is a mild season, for Brussels, so that there are quiet tree-tints, as in England.

Quercus rubra. Never, says M. Bommer, has much autumn tints, but the young shoots are reddish. It is the same at Kew, where I have observed it for some years.

Acer saccharum. Sugar maple; growing well here. At 12 years averages about 18 feet high: good autumn tints.

Prunus serotina. A fast-growing tree with mahogany-like

timber. At 12 years the three trees here average 5 inches diameter by 25 feet high.

Liriodendron tulipifera. At 11 years of age is nearly the size of the "common ash" at 30 years. For many purposes it is as useful a timber as *Fraxinus excelsior*, and for some purposes more useful. It does not seem to have received in England (U.K.) the attention that it deserves. The leaves, as with the "common ash" and many other trees of a temperate climate, are smaller than in South Africa.

Nyssa sylvatica. The best of all the trees here for autumn tints, but very slow-growing.

Quercus laurifolia, which was green at Groenendaal yesterday, has a deep copper coloration here; but, says M. Bommer, this may be a hybrid.

Liquidambar styraciflua is as brilliant in its autumn tints here as in South Africa or at Amàni—the botanical and forest station in German East Africa that some day may vie with Buitenzorg. Its leaves are here aglow with colour. This year at Kew the leaves are colourless. The difference struck me at once on my return to Kew. It is probably climatic.

Pseudotsuga Douglasii var. *glauca.* Colorado Douglas. This, they say, is the true Colorado Douglas: not a glaucous form of the Oregon Douglas.

It looks to me more like a spruce than typical Douglas. It is certainly different from the Colorado Douglas that I have frequently been shown in England, and is in fact much more like what one would expect in a tree from Colorado. It is still less like the *Pseudotsuga macrocarpa* figured at page 104 of Sudworth's *Forest Trees of the Pacific Coast.* And that tree seems properly sub-tropical and would probably not be growing here. This tree is slow-growing, not averaging more than 1 foot a year.

Picea pungens. Handsome but slow-growing. At 12 years the trees average about 10 feet high. They vary much in size and several have died recently.

Libocedrus decurrens. Does well here. A useful tree for South Africa, says my guide M. Bommer. It has been little planted there so far.

Abies concolor. Average of dominating stem 4 inches diameter at 25 years, shows a vigorous but slow growth, with 1 foot or 1¼ foot leading shoots. Almost the only dry-country silver fir,

says M. Bommer. The continental form is glaucous. The tree of the wetter coast ranges is green with leaves disposed flat. The two forms shown me were so different that I wondered if there were not some mistake. See above regarding the two forms of Douglas. Says M. Drion, there are two quite distinct forms (1) *Abies lasiocarpa* (= *A. concolor Lowiana*), and (2) *Abies concolor*. Some botanists consider these as different species and others as varieties. There are many intermediate forms between these two types.

Araucaria imbricata. Doing well both here and at the Groenendaal arboretum. The older trees in the Bois de la Cambre at Brussels give fertile seed; but few good seeds to the cones. The seeds themselves are equal to South American ones and germinate quite well, says M. Bommer.

The above notes were taken by me nearly a year before the war broke out. M. Drion had the MS. for some months, and I have since had a very busy time in Australia. Hence some delay in editing these notes. They will have a historical interest if the beautiful forest of Soignes has suffered, like so much else, from the German invasion of Belgium.

2. The Black Poplars.[1]

(*With Five Plates.*)

By Prof. A. Henry.

About ten years ago, when I began the study of different species for *The Trees of Great Britain and Ireland*, no group seemed so obscure as that of the cultivated poplars. Nowadays one knows that such a group probably comprises not only natural species and varieties, but also sports and hybrids. A natural species is a set of individuals uniform over a large area; or, in some cases, it consists of two or more geographical varieties which correspond to distinct territories. Such areas of distribution are delimited by conditions of soil, climate, etc. Hybrids, which occur in nature on the boundary line between

[1] A part of this article appeared in *Gardeners' Chronicle*, lv. pp. 1, 46, 66 (July 1914). We are indebted to the editor for the loan of the blocks of Figs. 1, 2, 3, 4, 5, 8 and 9. We are indebted to the Department of Agriculture, Ireland, for the loan of the block of Fig. 10.

areas occupied by two distinct species, are more likely to arise in nurseries or gardens where several species are cultivated together. The fine elm,[1] which is universally planted in Holland and Belgium, is not a natural species or variety peculiar to those countries, but a hybrid, as is shown by the nature of its seedlings. It is invariably propagated by layers, and originated probably as a single tree about 400 years ago.

Sports in trees arise in two ways, either as abnormal and often solitary seedlings in the seed-bed, or as a single peculiar branch on an otherwise normal individual. Sports, like hybrids, are usually propagated by grafting, layers, cuttings, etc. Both sports and hybrids may, through the readiness with which they can be multiplied, exceed natural species or varieties in numbers of individuals. Sports are generally selected for the curiosity or beauty of their appearance; whilst hybrids, especially first crosses, are mainly valued for the vigour of their growth. The origin of many cultivated trees can only be elucidated by a study of an historical character, supplemented by experiments, such as sowing large numbers of seeds to ascertain the characters of the resulting offspring. No genus shows more clearly than *Populus* the distinctions between natural species or varieties, sports, and hybrids.

The two wild species[2] of black poplar with which we are concerned in this article occur, one in Europe, the other in eastern North America. The European black poplar is distinguished from the American species by the absence of two characters in the leaves, viz. cilia on the margin and glands on the base of the blade in front. These are invariably present in the American species. In the flowers of the latter the stamens are 40 to 60, and the stigmas and placentæ, 3 or 4; in those of the former there occur 12 to 25 stamens, and only 2 stigmas and 2 placentæ. The shape of the leaf is markedly different; in the American species it is deltoid-ovate, as broad as long, contracting abruptly into a cuspidate apex, the base being shallow-cordate or truncate. In the European black poplar the leaf is longer than broad, being drawn out at the apex into a long acuminate point, while the base in well-developed leaves is wedge-shaped.

[1] *Ulmus latifolia*, Poederlé. For its history, see *Trees of Great Britain*, vii., pp. 1869, 1870.

[2] The only other species in cultivation in England, not mentioned in this article, is *Populus Fremontii*, Watson, which is still a rare tree in botanic gardens. It has leaves ciliate in margin, without basal glands.

Both these species have well-marked geographical varieties, there being a pubescent and a glabrous form of each.

Populus nigra is the comprehensive name under which Linnæus included all forms of the European black poplar; and as the tree planted by his own hands at Upsala is of the glabrous kind, we call this form *Populus nigra* var. *typica*. The glabrous variety appears to be strictly limited to southern and south-eastern Europe, being widely spread in southern Germany, Italy, Austro-Hungary, Balkan States, and southern Russia. It is rarely seen in cultivation in this country. Its natural habitat is the alluvial lands bordering on great rivers, like the Danube and its tributaries, and the Po and Volga.

The pubescent variety, *Populus nigra* var. *betulifolia*, has dense, short pubescence on its orange-yellow twigs, readily seen with a lens. It is apparently wild in southern England and throughout France, where I have seen it from Picardy and Normandy to the foot of the Pyrenees.[1] It is remarkable that while well known to the pre-Linnæan English botanists, whose numerous specimens may be seen in the British Museum, it first received a distinctive name[2] from Michaux, who saw a few trees in New York city and on the banks of the Hudson near Albany, evidently introduced from England. It has not spread in the United States, though it is said to be sold by nurserymen there under the name *Populus elegans*. The English or pubescent black poplar usually forms remarkable burrs on its trunk, and is a wide-spreading, graceful tree, the habit of which is shown in Fig. 1, from a tree growing near Bishop's Stortford. It attains an enormous size—one of the largest, which was cut down in 1912 at West Stow, near Bury St Edmunds, being 92 feet in height, and 19 feet in girth at 5 feet above the ground. This was a planted tree, as the original set, about 4 inches in diameter, was recognisable in the centre of the butt, being separated from the exterior wood by a ring-shake. Near the base 225 annual rings were counted. The timber was quite sound, the first length measuring 39 feet by 44½ inches quarter-girth, or 536 cubic feet, the total contents being 748 cubic feet. This species, being a native tree, occurs in both sexes; and seedlings that were raised in June, 1907, from seed of a tree at

[1] There are two fine trees at Lourdes on the side of the river opposite the shrine.

[2] *Populus hudsonica*, F. A. Michaux (1813).

19 Castle Street,
EDINBURGH, 27*th July* 1916.

DEAR SIR,

As you are no doubt aware, the question of National Afforestation is at length engaging the serious attention of the Government.

Any progress that has been made in forestry in Scotland during recent years has been largely due to the efforts of the Royal Scottish Arboricultural Society; and there can be no doubt that our aid will be sought in any future development. We ought, therefore, to see that we are in a position to speak with the greatest possible weight.

Our Society already includes a great number of men who are recognised authorities upon forestry: but we should have still more of them. The aim of the Society should be to include every one in Scotland who takes a real interest in the subject.

This is not the time to issue a public appeal for an increase of membership,—so many men who sympathise with our objects being away from home in the service of their country. But I venture to make this private appeal to you and others to assist us in increasing our numbers.

If every one who reads this letter will do his best to enlist at least one new member, he will be doing good service, not only to the Society, but to the cause we all desire to promote.

The name and address of any one whom you may persuade to join us should be sent to the Secretary, R. Galloway, Esq., S.S.C., at the above address.

Yours truly,

ANDREW N. AGNEW,
President, R.S.A.S.

FIG. 1. ENGLISH BLACK POPLAR (POPULUS NIGRA VAR. BETULIFOLIA), AT BISHOP'S STORTFORD.

[*To face p.* 16.

FIG. 2. FEMALE LOMBARDY POPLAR, AT KEW.

FIG. 3. HYBRID POPULUS HENRYANA, AT WHITE KNIGHTS

Bury St Edmunds which was pollinated by adjacent staminate trees, had attained 5 to 7 feet in height in October 1911. There are three English black poplars of great size in Green Park, about 100 yards from Piccadilly, opposite Down Street, London. This tree is eclipsed in rate of growth by the hybrids, and is of little value for commercial planting.

The Lombardy poplar (*Populus nigra* var. *italica*) is a sport, being the fastigiate form of the glabrous European black poplar, from which it differs only in the peculiar habit, all the branches being directed vertically upwards. Much erroneous matter has been written about the origin of this tree, some old writers considering it to be a distinct species, native of Asia Minor or Persia. I have given elsewhere[1] historical evidence proving that it originated, probably as a single tree, between 1700 and 1720 in the plains of Lombardy. From here it spread rapidly by cuttings over the whole world, reaching France in 1749, England in 1758, and the United States in 1784, while it was carried to the Levant about 1750 by the Genoese. It is unknown except as a planted tree in Asia Minor, Afghanistan, and India.

The original Lombardy poplar was a staminate tree, and all trees propagated from this are consequently of the male sex. The rare female Lombardy poplars, which have been reported to occur in Germany from time to time, have not strictly vertical branches, and appear to be seedlings from poplars of the ordinary spreading form, which were pollinated by the pollen of the Lombardy poplar. The only female Lombardy poplar with a truly fastigiate habit which I have seen is a tree (Fig. 2) in Kew Gardens, about 50 feet high, which produced pistillate catkins in 1908, 1910 and 1914. The origin of this is quite unknown.

Populus plantierensis[2] is the fastigiate form of the pubescent (or English) black poplar, and derives its name from the nursery of Simon-Louis at Plantières, near Metz, where it originated. M. Jouin, the present proprietor of this famous nursery, where

[1] *Trees of Great Britain and Ireland*, vii., 1798 (1913). Seguier, in *Plantæ Veronenses*, ii., 267, published in 1745, states that the fastigiate and ordinary black poplars differ only in habit, and in the first being a planted, the latter a wild tree.

[2] So named by Dode (1905). This name is convenient, but it is more properly called *Populus nigra* var. *plantierensis*, Schneider (1906).

so many sports and hybrids have been raised, told me that there existed in 1868 a line of female trees of *Populus nigra* var. *betulifolia*, alongside some Lombardy poplars, and that fifteen seedlings of fastigiate habit were found, which constituted the original stock (both sexes occurring). One of the original trees, which is a male, measured 74 feet high by 5 feet in girth in 1908. This tree can only be distinguished from the ordinary Lombardy poplar by its hairy twigs and petioles. It is doubtful if it is more vigorous, but its growth can be seen at Kew and at Glasnevin, where there are excellent specimens of this and most of the other remarkable poplars.

The fastigiate habit may occur as a sport in any species of tree. Some are still very rare in cultivation, as the fastigiate beech, which is only known as a single tree at Dawyck, and the fastigiate Scots pine, the original example of which is at Dryburgh. Amongst the cypresses and junipers, fastigiate seedlings are more numerous than in other genera, and appear to breed true to the habit. Lord Selborne gathered from an upright Mediterranean cypress at Scutari in 1884 two or three cones, which lay forgotten in a drawer till 1895, when their seeds were sown. Seventeen seedlings resulted, all like the parent in habit. These were about 6 to 15 feet in height at Blackmoor in 1910. With an increase from seed in the number of fastigiate individuals, as occurs in the cypress, we see the transformation from a sport to a constant form, which, if more suitable than the spreading ordinary form in some environment, might become by selection a geographical variety.

In North America, east of the Rocky Mountains, there occurs one species of black poplar, divisible, like the European species, into distinct geographical varieties. This widely-distributed American poplar has been identified by American botanists with *Populus deltoidea*, Marshall, an old name to which is attached a vague description. The first certain description of any form of the species was given under the name *Populus monilifera*, Aiton, a type specimen of which can be seen in the British Museum; and I adhered to this name in *Trees of Great Britain*, vii., 1807 (1913); but as the business of nomenclature is to get some name fixed to a species, I think it now better to adopt the name favoured by American botanists.

There are three distinct forms of the American black poplar in the wild state, all of which have identical floral characters,

and all differing in foliage from the European species as given above. These are distinguishable as follows :—

1. *Populus deltoidea* var. *monilifera*, Henry [*Populus monilifera*, Aiton, *Hort. Kew.*, iii., 406 (1789)].

Leaves deltoid-ovate, about 3 inches long and wide, abruptly contracted into a long non-serrated apex; base wide and shallowly cordate, bearing two glands at the junction with the petiole in front; margin densely ciliate; both surfaces and petiole quite glabrous, except for a few evanescent hairs on the midrib and main nerves.

This variety, which may be conveniently called *P. monilifera*, is wild in Ontario, Quebec, New England, New York and Pennsylvania. Its habit is shown by Fig. 4, representing a tree growing near Ithaca (N.Y.), about 100 feet in height and 13 feet in girth at 5 feet above the ground.

This poplar was introduced early (about 1700) into France and England, but has not been propagated for many years as it was supplanted by the fast-growing hybrids. The only tree that I have seen in England was one in the Cambridge Botanic Garden, cut down some years ago, but replaced by a cutting, which is thriving. There are two other old trees in England which have been identified with this species. No tree is more easy to identify by the form of the leaves; and it is remarkable that the unlikeness of the hybrid forms escaped notice, the latter still masquerading in books and nursery catalogues as *P. monilifera* or its synonym *P. canadensis*, names only applicable to the true American species.

2. *Populus deltoidea* var. *occidentalis*, Rydberg [*Populus Sargentii*, Dode (1905); *Populus occidentalis*, Britton (1906)].

Leaves smaller than in the preceding, thicker in texture, and lighter in colour, deltoid, truncate at the base, with fewer and coarser serrations; glabrous.

This, which is the xerophytic form of the species, grows in North America in the territory east of the Rocky Mountains, from Saskatchewan and Alberta southwards to New Mexico and western Texas, and is the characteristic tree on the river flats of the western prairies. It has not been introduced.

3. *Populus deltoidea* var. *missouriensis*, Henry [*P. angulata* var. *missouriensis*, Henry, in *Trees of Great Britain*, vii., 1811 (1913)].

Leaves similar in shape to those of var. *monilifera*, but larger,

5 or 6 inches in width and length; both surfaces of the leaf and petiole pubescent, some of the pubescence remaining in summer; basal glands three or four.

This variety occurs in the south and south-eastern parts of the United States, ascending the Mississippi basin from Louisiana to Missouri; also in Georgia.

This large-leaved, more pubescent form is probably the large poplar referred to by Marshall as growing on the banks of great rivers in Carolina and Florida, but I have seen no specimens from there. If these turn out to be identical, this form may be considered to be typical *Populus deltoidea*, Marshall.

I have seen no tree of this variety in Britain; but it is occasionally cultivated in southern France and in Italy.

Hybrid Poplars.

The black poplars which are extensively cultivated for timber in France and Belgium, and also in England, are almost invariably of hybrid origin. This fact is easily established from their history and from a study of their botanical characters. With the introduction at the end of the seventeenth century of American trees into Europe, hybrids between them and the allied European species soon began to appear as natural seedlings in nurseries, and in no genus are they so readily produced as in *Populus*, where the individuals occur in two sexes. Moreover, hybrid seedlings are early noticed as endowed with exceptional vigour, and the propagation of any vigorous seedling poplar by cuttings is so easy that it was often done. I have given elsewhere[1] the history of the different hybrids, and I need only now indicate the characters by which they differ from the parents which are, on the one hand, the glabrous or the pubescent European black poplar, and, on the other, *Populus deltoidea*. The hybrids have leaves intermediate in shape, never shallowly cordate at the base as in *P. deltoidea*, and never cuneate as in *P. nigra*; cilia on the margin sparse and irregular; basal glands variable on the leaves of the same branch, absent or one or two, not invariably[2] present as in *P. deltoidea*, nor always absent as in *P. nigra*.

[1] *Trees of Great Britain*, vii., 1814 (1913).

[2] In *Populus angulata*, the glands are always present, constituting an exception in this respect to the other hybrids.

FIG. 4. AMERICAN BLACK POPLAR (POPULUS DELTOIDEA VAR. MONILIFERA), NEAR ITHACA (N.Y.).

[*To face p. 20.*

Fig. 5. Black Italian Poplar (Populus serotina), at Belton.

The principal hybrid black poplars are :—

1. *Populus angulata*, Aiton (1789). This has been cultivated in England and France since 1750, always being popularly known as the Carolina poplar. It was said by Michaux to be common in the two Carolinas and the other southern States, but it has never been recognised as a wild tree in any part of America. It differs remarkably from *P. deltoidea* in the scales of the flowers, which are small, cucullate or concave, simply dentate and not divided on the margin into long filiform lobes. The flowers, which occur in both sexes, are, however, often malformed, and I formerly considered that *P. angulata* was merely one of the forms of *P. deltoidea* which underwent a mutation in its flowers after cultivation in Europe. Though in most respects the leaves, which persist green on the tree till late in November, are similar to those of *P. deltoidea* var. *missouriensis* yet they are not identical, as they tend to be longer than broad, rounded or acute (rarely acuminate) at the apex, deeply cordate or truncate at the base, and are glabrous except for the pubescent petioles. I now believe that *P. angulata* originated as a seedling of a female *P. nigra typica*, the flowers of which had been pollinated by a male *P. deltoidea missouriensis*. The persistence of the leaves till late in autumn is due to the southern origin of the male parent, which was introduced into France from Carolina about 1700. The latter tree, the true Carolina poplar, was soon neglected, its place and name being taken by its more vigorous hybrid offspring.

There are a few fine examples of *P. angulata* in England, the most remarkable being a very old tree at Danny Park, Sussex, which has layered, producing a great number of stems, and altogether covering an area over 150 yards in circumference. The hybrid Carolina poplar is more suitable, however, for the climate of the south of France and of northern Italy, where it is common in avenues and in plantations.

2. *Populus serotina*, Hartig (1851), otherwise *Populus helvetica*, Poederlé (1792). This, which is a male tree, is always known in England as the black Italian poplar, and in France as Peuplier suisse or (erroneously) Peuplier de Virginie. It appears to have been one of the earliest hybrid poplars to be selected, being described by Duhamel in 1755, and introduced into England before 1787. It has glabrous twigs

and leaves, and is the latest of all the poplars in unfolding its leaves, which in the young state have a fine bronzy tint. The parents, judging from the botanical characters and the late opening of the foliage, were evidently *P. nigra typica* and *P. deltoidea monilifera*. The latter had been introduced into France from Canada, where it is wild in the valley of the St Lawrence. The black Italian poplar has a characteristic habit and can be readily distinguished, even a mile off, by its ascending branches and wide head, as is well shown in Fig. 5, which represents a tree at Belton, near Grantham, about 125 feet in height and 15 feet in girth at 5 feet from the ground. Mr A. B. Jackson records one at Albury as 150 feet in height. The remarkable fast growth of this valuable poplar is evidenced by a tree, exactly 100 years old, which was felled at Cassio Bridge, near Watford, in 1907. It was 130 feet in height, and 16 ft. 11 ins. round the trunk at 5 feet up, the contents of the butt being 701 cubic feet, and of the timber of the whole tree about 1000 cubic feet.

3. *Populus regenerata*, Schneider. This is a female tree, exactly resembling the black Italian poplar in twigs and leaves, but the latter open at least a fortnight earlier. In habit this is narrower in outline (see Fig. 6). Most of the so-called eucalyptus poplars are really this hybrid, which appears to have been picked up as a seedling in a nursery near Paris in 1814. In France it is now more common and grows faster than *P. serotina*, and at Pontvallain has attained, in 22 years from the planting of the set, 110 feet in height and 6 ft. to 6 ft. 10 ins. in girth. At Culford, Suffolk, a plantation of these trees, 14 years old, averaged 55 feet in height in 1913.

4. *Populus Eugenei*, Simon-Louis. This is a male tree, with twigs and leaves similar to those of *P. serotina*, but the leaves are smaller and open earlier, and in habit it is distinctly narrower than the black Italian poplar. It was found in 1832 as a chance seedling in a bed of silver firs in the nursery of Simon-Louis, near Metz. The only female poplar then existing in this nursery was *P. regenerata*, which was very probably fertilised by the pollen of a Lombardy poplar near by, these two poplars being evidently the parents of this remarkable hybrid. The original tree is, in my opinion, the most wonderful tree in Europe in point of vigour, as it measured in 1913, when 81 years old, no less than 150 feet in height and 25 feet in girth at 5 feet above the ground, and appears to be still growing rapidly.

PLATE III.

FIG. 6. POPULUS REGENERATA, AT GLASNEVIN.

FIG. 7. POPULUS EUGENEI, AT KEW.

[To face p. ...

FIG. 8. POPULUS ROBUSTA, AT GLASNEVIN, ON THE RIGHT; ORDINARY LOMBARDY POPLAR ON THE LEFT.

Another tree, a cutting of the last, planted in 1870, was 140 feet high by 15 feet in girth. *P. Eugenei* thrives in sandy soil at Kew, where, of eight trees 24 years planted, the two largest, in 1912, measured 90 feet by 5 ft. 1 in. and 84 feet by 4 ft. 5 ins., whilst the others ranged from 50 to 60 feet in height and 2 ft. 4 ins. to 3 ft. 5 ins. in girth. All preserve the narrow pyramidal form (see Fig. 7).

5. *Populus Henryana*, Dode (see Fig. 3), is one of the hybrids with a branching habit, recalling that of *P. monilifera*. It is a staminate tree, with leaves cuneate at the broad base. It is very rare, and is probably of no particular vigour, but forms a picturesque tree when old, as shown in the illustration, which represents a fine specimen at White Knights, about 100 feet in height and 14 feet in girth. The origin of this hybrid is unknown.

6. *Populus marilandica*, Bosc. This hybrid, like the preceding five, has glabrous twigs, but the leaves in shape strongly resemble *P. nigra*, from which it may be distinguished by the presence of glands at the base and stray cilia on the margin of the blade, and by the placentæ and stigmas being variable, 2, 3, or even 4 in number. This originated early in the nineteenth century, and specimens so named from trees at Montpellier in 1833, and Carlsruhe in 1845, can be seen in herbaria. It is always female, and has been erroneously identified by Hartig, Koehne, Schneider, etc., with *P. canadensis*, Michaux, which is one of the later names of the true American species. It is not very vigorous, but a tree at Kew near the palm-house measures 90 feet high by 8 feet in girth.

The two remaining hybrids (7 and 8) have as one parent *Populus nigra* var. *betulifolia*, and in consequence their twigs are covered, like it, with pubescence. In the preceding six hybrids, the corresponding parent is the glabrous *Populus nigra*, either in its ordinary spreading form (var. *typica*) or in its fastigiate sport (Lombardy poplar), and in consequence the twigs are glabrous.

7. *Populus robusta*, Schneider (see Fig. 8). This was found in 1895 in Simon-Louis' nursery near Metz, and during my visit there in 1913 I was shown the spot where the seedling was picked up, about 20 feet distant from an old tree of *Populus angulata* (about 80 feet high and 8 feet round). This bears female flowers regularly; and one of these, giving origin to the seedling, must have been pollinated by the pollen of *Populus*

plantierensis, a tree not far off (see p. 17). From the latter parent is derived the hairy twigs and the narrow columnar habit, with ascending (not vertical) branches, which characterise *P. robusta*. This is believed by M. Jouin to be the finest of all the hybrids, and three trees on good soil in his nursery are at 18 years old about 90 feet in height, with stems $5\frac{1}{2}$ to $6\frac{1}{2}$ feet round at 5 feet from the ground. At Glasnevin, on poor, shallow soil, in an exposed situation, there is a fine specimen of *P. robusta*, which was obtained as a cutting in 1899. It measures about 46 feet in height and 2 ft. 4 ins. in girth. Its remarkable straight stem, with very narrow ascending branches, is well seen in Fig. 8 contrasting with the fastigiate habit of the much older Lombardy poplar on the left. If this tree is found to bear wind well, as it appears to do at Glasnevin, it may be of considerable economic importance in Ireland, where the black Italian poplar is broken to pieces by the constant prevailing wind and heavy storms that are so common in most districts. It would provide speedily excellent timber for box-making, as the stem can be pruned readily to a considerable height before the branches become too large.

8. *Populus Lloydii*, Henry (see Fig. 9), is similar to *P. robusta* in the pubescent branchlets and shape of the leaves, but is a female tree with flowers bearing 2 or 3 stigmas. Its origin is obscure, but one of the parents is probably the English black poplar (*P. nigra* var. *betulifolia*). The only large specimens that we have seen are at Leaton Knolls, near Shrewsbury, the residence of Major Lloyd, where three trees measured, in 1910, 120 feet high by 13 feet in girth, 110 feet by 11 ft. 2 ins., and 98 feet by $10\frac{1}{2}$ feet (see Fig. 9). Smaller trees have been noticed near Cambridge, and at Turnham Green, London.

Until lately all the hybrid poplars in cultivation had originated as chance seedlings (the result of accidental crossing by wind-pollination), which observant nurserymen or gardeners found desirable to propagate on account of their vigour. The artificial production of fast-growing hybrids is now being attempted. The most interesting so far obtained by me is one named *Populus generosa*, which was raised from seed produced in 1912 by fertilising a *Populus angulata* (♀) tree at Kew with pollen of the Pacific Coast (U.S.) balsam poplar (*P. trichocarpa*). Four seedlings (Fig. 10) were obtained, which have made very rapid growth and bear beautiful large leaves intermediate between the

FIG. 9. HYBRID POPULUS LLOYDII GROWING AT LEATON KNOLLS, SHREWSBURY.

[*To face p.* 24.

FIG. 10. POPULUS GENEROSA, TREE 27 MONTHS OLD, FROM SEED.

two parents. It will be noticed that this new hybrid is a cross between two poplars belonging to different sections of the genus. *Populus generosa*, Henry, was first described in *Gardeners' Chronicle*, lvi. 258 (17th October 1914); but the reader's attention may be drawn to the account of this and other artificial hybrids, which has been published in *Journal of Department of Agriculture, Ireland*, xv. 44, fig. 6 (October 1914). *Populus generosa* is easily propagated by cuttings, and will shortly be on sale at a trade nursery, where the valuable *P. robusta* also is obtainable.

The following Key, together with Figs. 11 and 12, reproduced from *Trees of Great Britain*, vol. vii. t. 409 (1913) will serve for the discrimination, by the leaves and twigs, of the various poplars mentioned above. The black poplars constitute the section *Aigeiros*, Duby in De Candolle, *Syn. Pl. Fl. Gall.* i. 427 (1828), and are distinguished from the other groups (aspens, white poplars, balsam poplars, etc.) by their leaves, green on both surfaces and bordered with a clearly defined translucent margin.

KEY TO THE BLACK POPLARS.

I.—Leaves never ciliate in margin.

1. *Populus nigra*, Linnæus. Wild in Europe, Caucasus, Siberia.

Leaves rhomboid, about 3 inches long, 2 inches broad, cuneate at the base, gradually tapering above into a long acuminate apex; glands never present on the base. Stigmas 2. Stamens 15 to 30.

Branchlets and petioles glabrous in var. *typica*, pubescent in var. *betulifolia*.

The Lombardy poplar (var. *italica*) is the fastigiate sport of var. *typica*, and var. *plantierensis* is the fastigiate sport of var. *betulifolia*.

II.—Leaves ciliate in margin.

* *Glands absent on the base of the leaf.*

2. *Populus Fremontii*, Watson. Wild in California, Utah, Texas.

Leaves on young cultivated trees, reniform or rhombic, with a cuneate base; on old trees deltoid with a truncate base; about 2½ inches wide; apex cuspidate; serrations few, coarse, incurved. Stigmas 3. Stamens about 60.

** *Glands always present on the base of the leaf.*

3. *Populus deltoidea*, Marshall, var. *monilifera*, Henry, in *Gardeners' Chronicle*, lvi. 2 (4th July 1914).

[*Populus monilifera*, Aiton.]

Twigs rounded. Leaves deltoid-ovate, about 3 inches wide, shallowly cordate or truncate at the base, cuspidate at the apex; serrations sinuate

with incurved tips, fewer and coarser than in its hybrids. Stigmas 3 or 4. Stamens 50 to 60.

4. *Populus deltoidea*, Marshall, var. *missouriensis*, Henry, in *Gardeners' Chronicle*, lvi. 46 (18th July 1914).

Twigs angled. Leaves similar in shape to the last, but larger, 5 to 6 inches wide and long; petiole and both surfaces pubescent, some of the pubescence persisting in summer; basal glands 3 or 4. Stigmas 3 or 4. Stamens 50 to 60.

5. *Populus angulata*, Aiton, *Hort. Kew.*, iii. 407 (1789).

[*Populus deltoidea*, var. *missouriensis* × *Populus nigra* var. *typica.*]

Twigs angled. Leaves similar to the last, but longer than broad and differing in the rounded or acute apex, deeply cordate or truncate at the base, glabrous except for the pubescent petioles; basal glands 3 or 4. Flowers with small, dentate scales. Stigmas 4. Stamens 50 to 60.

*** *Glands variable at the base of the leaf, absent or one or two in number.*

Hybrids between the European *P. nigra* and the American *P. deltoidea* var. *monilifera.*[1] Leaves with irregular marginal cilia, which are often sparse and usually deciduous in summer; serrations not coarse and not sinuate.

† *Branchlets glabrous.*

6. *Populus serotina*, Hartig.

Branches ascending, wide-spreading. Leaves unfolding latest of all the poplars and with a red tint, ovate-deltoid, about 3 inches wide, with a broad truncate base. A staminate tree; stamens 20 to 25.

7. *Populus regenerata*, Schneider.

Similar to *P. Eugenei* in habit; with foliage like that of *P. serotina*, but unfolding a fortnight earlier. A pistillate tree; stigmas usually only 2.

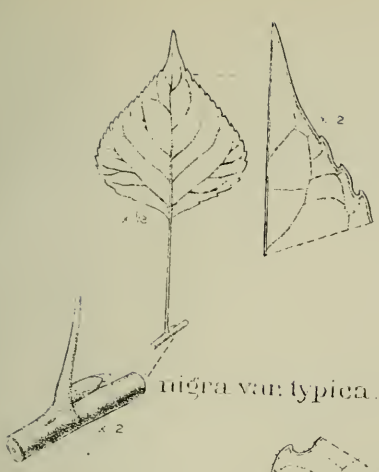
8. *Populus Eugenei*, Simon-Louis.

A narrow columnar tree with short ascending branches. Leaves unfolding early with a reddish tint, smaller than those of *P. serotina*, broadly cuneate at the base, with a slender sharp-pointed non-serrated acuminate apex. A staminate tree; stamens about 20.

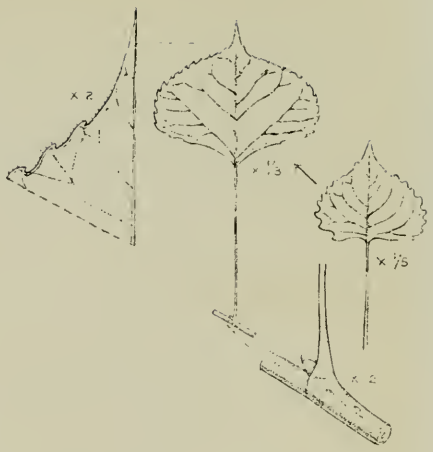
9. *Populus marilandica*, Bosc.

A tree with irregular branches. Leaves early in unfolding, rhomboid, cuneate at the base, tapering into a long acuminate apex. A pistillate tree; stigmas variable, 2, 3, or 4.

[1] *P. robusta* excepted.



nigra var: typica.



Fremontii.

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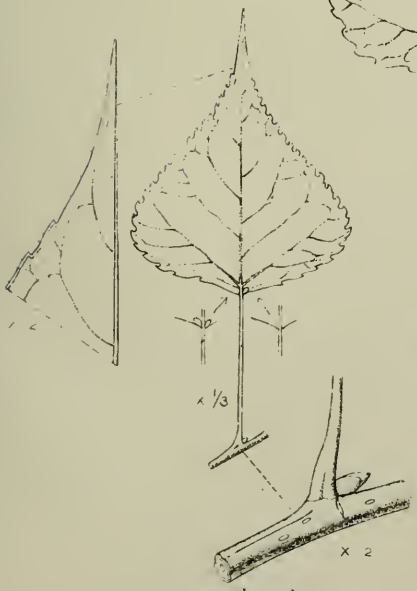


marilandica.

Lloydii

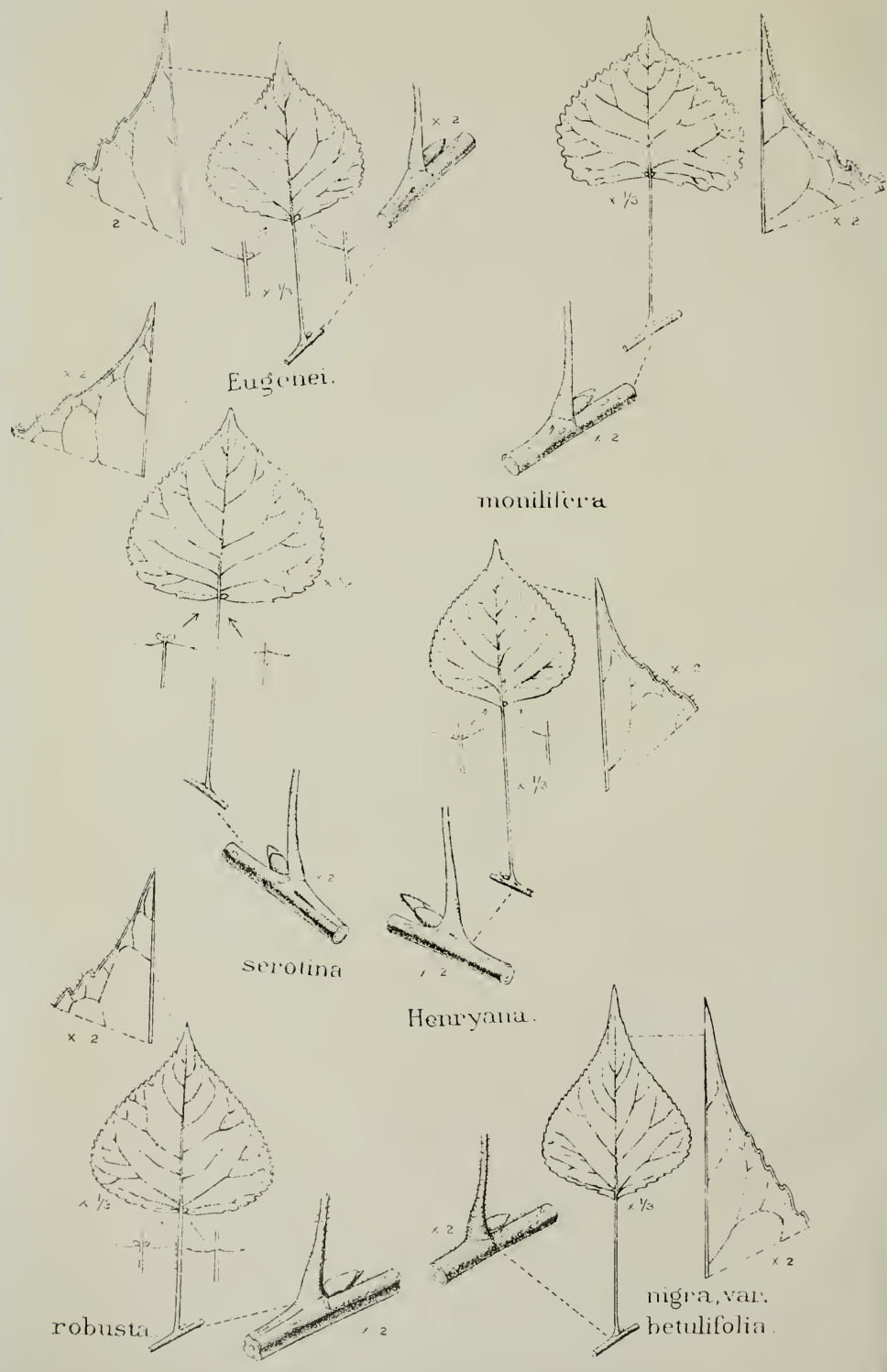


Fig. 12. Leaves and Twigs of Black Poplars.

10. *Populus Henryana*, Dode.

A tree with irregular branches. Leaves opening early, not tinged with red, ovate-triangular, cuneate at the broad base, and ending in a long acuminate apex. A staminate tree; stamens 30 to 35; flower-buds pubescent.

‡ *Branchlets pubescent.*

11. *Populus robusta*, Schneider.

[*Populus angulata* × *P. nigra plantierensis.*]

A tree with a narrow columnar crown, and very short ascending branches. Twigs grey. Leaves unfolding early with a red tint, slightly larger than those of *P. serotina*; variable in shape, ovate-deltoid or rhomboid; cuneate, rounded or truncate at the base; acuminate at the apex; petioles pubescent. A staminate tree; stamens 20.

12. *Populus Lloydii*, Henry, in Elwes and Henry, *Trees of Great Britain*, vii. 1830 (1913).

[*Populus serotina* × *P. nigra betulifolia.*]

A wide-spreading tree. Twigs yellow. Leaves similar to those of *P. robusta*, but considerably smaller; petioles pubescent. A pistillate tree; stigmas usually 2.

3. Some Observations on Planting New Ground.

By John Boyd.

It will be admitted by the majority of foresters that we are still feeling our way, to a great extent, in the subject of "the afforestation of waste land," *i.e.* land which competent judges consider capable of growing timber and which would be more profitably utilised in growing such a crop than under its present use. Therefore it may not be out of place to make a few observations on several phases of the subject that have appealed to the writer during a few years' practical experience of the work, with the hope that they may interest readers, and probably be of some service in the future, when there may be greater opportunities, or even need, for the development of this particular branch of forestry. It is not proposed to lay down any hard and fast rules that will be applicable under all circumstances or conditions; but rather to place on record some ideas that have occurred to the writer, and that have been put into practice to some extent, and to offer a few opinions on the results, some of a more or less general character and others on matters of detail, with the

caveat that any opinions expressed are subject to revision should future experience call for that.

In considering any tract of land—be it large or small—with a view to afforestation, it is well to bear in mind that in this country, small as it is, the vagaries of climate and soil are so rapid and great, that even within a very limited area it may be necessary to consider very small sections, because what may suit one place may be quite unsuitable or inapplicable to another only a few hundred yards distant. Hence for a detailed planting scheme it is not advisable to go through an apparently suitable district, giving it a general inspection, getting a general view of the lie of the land, an idea of the nature of the soil, subsoil, and underlying rocks, and from such cursory observations to form an opinion as to the suitability or otherwise of such and such a place as a subject for a scheme of afforestation under which certain species are to be grown. Conclusions should be arrived at only after a careful investigation and consideration of every detail which is likely to affect the success or failure of the proposed project for the present, the immediate, and the distant future. It is a many-sided question, and the various aspects will readily occur to those interested. Those most familiar with our highlands and southern uplands will no doubt agree that this principle cannot be too carefully borne in mind, as there are few districts which will not give a better or a worse impression from a general view or survey than they would give under a careful scrutiny, and this may be illustrated by some of the following observations.

Exposure and Shelter.

In reference to aspect or exposure it has been observed that, within the space of one mile, the altitude up to which trees will succeed may vary several hundred feet by going from N.E. to S.W. over an exposed ridge running at right angles to these points, and that with the very uneven nature of the ground, especially in the West Highlands, it is frequently very difficult to form correct ideas as to what are the most sheltered places for trees which require more or less protection. High winds play all sorts of pranks by forming eddies or miniature whirlwinds, and one may find, in places that appeared to be well sheltered, that plants 4 to 5 feet high get whirled about to such

an extent as to be rendered useless, if not torn out of the ground altogether. Under such conditions the formation of shelter-belts or screens is a problem of great difficulty. It is advocated by some authorities that the formation of shelter-belts should be a preliminary to any scheme of planting, which under certain conditions is a commendable plan. Yet it is questionable if it is applicable or justifiable under all circumstances; and although there may be cases where it is both applicable and practicable, there may be others where it is neither, but in which it may be found quite as effectual, much simpler, and more economical to ignore shelter screens in the initial stages of planting of irregular ground, unless by planting wind-firm trees on decidedly exposed ridges. Then, after some years' observations, suitable trees should be introduced among those already established, where there is evidence of the wind being mischievous.

Soil and Herbage.

Within certain limits quality of soil is of the greatest importance to the planter; and it will also, in many instances, prove the most difficult subject to get a good grasp of, because in many localities the changes are both great and frequent even within very limited areas. So much is this the case in the West Highlands that it is extremely difficult, and frequently impossible, to find a compact area of two or three acres of even or regular quality—peat bogs excluded, and even they are very changeable. Some advocate the necessity of a thorough examination of the soil as to quality, depth, etc., which, under the conditions indicated above, would be an extremely laborious and tedious process; and the opinion is ventured here that an equally effective and much simpler and easier method is a careful and critical examination of the herbage or plant growth on the surface, both in summer and also in late autumn or winter. It is not possible, here, to enter into this subject in detail, as it is a big one, and would demand a more extensive botanical knowledge than is claimed, and also an equivalent knowledge on the part of our readers. Yet some of the more important features may be referred to in connection with some well-known plants. The common bracken—the plague of the sheep farmer—might safely be styled the fore-runner of the forester; because where the bracken is found—

within reasonable altitudes—in any quantity, the planter may follow, generally, with trees of good timber qualities, *e.g.* larch, etc. Yet a certain amount of discrimination is necessary, and it is advisable also to take into consideration the grasses that grow along with the bracken. One notable illustration may be stated. Several instances having come under observation where bracken and the soft grass *Holcus lanatus* were found in company, larch and Douglas when planted proved an almost complete failure, which on being rectified by substituting silver fir, common or Sitka spruces, resulted in as complete success The grass named is always found on soil of the best quality with a good degree of moisture; but it is questionable if the moisture is the sole cause, as larch does very much better on soil carrying *Festuca elatior*, which is also a lover of a high degree of moisture, but thrives on a soil of inferior quality. Neither was the failure due to the propensity of *Holcus* for overlaying and smothering plants. The question may therefore be asked, Does *Holcus* produce any toxin in the soil which may be injurious to certain trees? It need scarcely be said that bracken does not frequent soils with a high degree of moisture, therefore, when damp or wet soils are under consideration some other form of vegetation has to be looked for as a guide. On the best classes of such soils spruce is almost certain to give satisfactory results, provided the ground is sufficiently drained. It may be remarked, however, that rushes—either single or tufted—almost invariably indicate good spruce soils, and where they are thin and not over strong in growth, little or no draining may be necessary. Coming to peaty soils, the rush is again the best guide that can be found, as it is to be met with only in the better parts of such. Pure peat may also be very well classified at its face value, and it has been observed that this value is not so much dependent on depth as on quality, and the quality is indicated in a very accurate manner, to the practised eye, by the nature of the herbage it carries. In all cases where rushes are in evidence, it has been found that peat is capable of growing spruce; and also where a crop of bog myrtle grows it will usually serve the same purpose. In both cases, however, good drainage is necessary.

The worst class of plants met with on the hills belongs to the genus "Scirpus," which invariably indicates a class of peat that has to be very carefully considered or rigorously ignored; it

matters little whether the peat be nine inches or nine feet deep. It is altogether useless to treat such peats unless some grass is found among the Scirpus, and even large areas with only a little grass should be avoided or treated experimentally on a small scale, as experience alone will prove their value. If draining increases the proportion of grass in a marked degree, there is a possibility that such places may be brought in to a condition fit to grow spruce, but if drainage does not increase the proportion of grass, then these places are in all probability hopeless, and it would appear that the process of improvement is a very slow one. It has also been noted that this quality of peat, when found on a slope immediately above good soil, depreciates the value of the latter very seriously by the downward flow of water charged with injurious acids. Such slopes require draining, although they may not appear to have much need of it unless by the unhealthy appearance of the herbage. It is also very necessary to stop the onflow by a good drain along the margin of the peat; without this the soil will prove inimicable to tree-growth. Cotton grasses and sphagnum mosses in abundance are also forms of herbage which indicate a quality of peat that should be avoided; they are usually met with on flat situations of a more or less swampy nature, not infrequently the sites of former lochs, and around the sides of shallow lochs undergoing the process of being filled up by the growth of aquatic plants. All such ground is practically valueless unless it has reached the stage capable of growing rushes.

Reverting to observations of a more general character, instances may be found in several areas where spruce has made a very poor appearance, with many failures, but with patches here and there showing quite satisfactory results; and in every case where the growth has been satisfactory, the nature of the herbage indicates a better quality of soil. This may be observed at all altitudes up to about 900 feet, and near that altitude several patches of silver fir have been successful on spots where the herbage indicated a quality of soil that would suit them. Therefore the inference is, as already stated, that quality of soil is the most important feature to be considered, and that the soil value is most easily arrived at by a careful study of the herbage, which does not necessarily require a particular knowledge of the names of plants, but rather a sense of discrimination of which plants indicate soils suitable for

certain trees, and which are likely to be inimicable to any or all trees.

Features of Trees.

As the result of observations for some years, the writer has formed an opinion—which he ventures to put on record—regarding the comparative soil requirements of European and Japanese larches. It first occurred to him as a result of observations in the nursery, and it has been tested and apparently confirmed in the plantations, namely, that the Japanese larch is much less exacting on soil fertility than its European relative, and recently it has been made a practice to use them together in groups or blocks on variable soil, relegating to each its appropriate place in smaller groups or patches according to the soil variations. Although the tests have not been sufficiently prolonged to enable one to speak with certainty, yet the indications favour the opinion expressed, and tend to demonstrate that Japanese larch will give satisfactory results on soils where the European larch would fail.

This leads to some observations of a similar nature—based on experience—concerning the merits of common spruce and Sitka spruce. It is frequently maintained that the latter compared with the former stands in the same relationship as Japanese and European larches, yet in this locality the development of the two species does not seem to bear this out to any appreciable degree. On spruce soils of a good and fair quality it would appear that, as a rule, Sitka establishes itself more quickly, and may have an advantage in that sense, since, as is well known, it has a natural tendency to grow much more rapidly, but as regards general health there is no comparison between the two. On poorer soils and on peat the difficulty in becoming established would appear to be less marked, and the rate of development would appear to be more equal so far as present observations go, but on ground of doubtful quality the Sitka spruce has not proved its superiority over the common spruce to any appreciable extent. On such soils the development of each may be said to vary, just as the soil varies. No instance has yet come under observation where it can be claimed that Sitka spruce has proved a success and common spruce a failure under equal conditions.

Best Season for Planting.

Until recently the writer believed in and practised late spring planting. It is a fairly popular belief, that to have successful results in transplanting Douglas fir and Sitka spruce the work has to be undertaken in late spring, and no doubt, speaking generally, the best results will be attained with these and with most evergreens by late spring planting, but that is rather beside the question. For reasons which need not be entered into, planting here has to be commenced as early as possible in autumn and continued through winter and spring until well on in May. It is also a more or less general rule to plant in pure groups or blocks according to soil and other conditions. Under these conditions, and admitting that the trees named could only be planted in late spring, it will be readily understood that it was somewhat inconvenient to have to go over the ground planting certain varieties when suitable and leaving for late spring planting such places as were set apart for Douglas and Sitka. This led, some years ago, to experiments being made in planting a few hundreds of each of these species at various seasons, and planting at those seasons which proved successful was repeated in succeeding years with the same satisfactory results, so that for the two past seasons (1913-14, 1914-15) the practice has been to plant the ground straight ahead, and so far no ill results have followed. In the first-named year all the Douglas excepting a few thousands were planted during December and the remainder in January, with a death rate of beween two and three per cent., and a great number of Sitka were planted at the same time with rather better results. It may, however, still prove to be the case that the mild winters of late have had something to do with the success, or it may be that the mild climate of West Argyll may permit of innovations of the above nature, whereas in a more rigorous climate such methods might result in failure; further, the results of a few years' experience are not quite sufficient on which to form a decided opinion. It might, therefore, be very instructive if some experiments of the same nature were made in different localities; because, as indicated earlier, we want all the information that can be got on these, and other points of interest; and the more information that can be got is so much the better for the cause of forestry.

4. The Forests of Australia.[1]

By D. E. Hutchins, F.R.G.S.

I am a retired member of the Indian Forest Service, but have spent most of my life in South Africa, where forestry is some quarter of a century ahead of Australia. When I went to South Africa in 1883 an eminent French forester, Comte de Vasselot, was then engaged in organising forestry on the scientific lines adopted in Europe. That was the foundation of forestry as it exists to-day in South Africa, where some £2,500,000 sterling has been spent on forestry, with the main object of producing in the country the timber which is now being imported at a yearly cost of some £1,250,000. South Africa is now spending £145,000 yearly on forestry; the forest revenue is at present £50,000. The indigenous forests of South Africa are managed on the same lines as are forests in Europe, America and Japan, or wherever, indeed, the forests are scientifically managed; but the indigenous forests are small in area, and have had to be supplemented by large areas of forest planting, some 80,000 acres up to date. Pines are largely raised by the inexpensive process of ploughing the ground and sowing pine seed broadcast like a field of wheat; cluster and canary pine are the two chief pines planted. As much as 32 tons of pine seed have been used in this way in one year—the average during the last three years being 25 tons.

I went to Australia with the British Association in 1914, and spent six months on a forest tour in the various Australian States—the most interesting six months of my life. For my life's work has been trees and forestry, and I am now seeing, growing in their own home, those Australian trees, especially the eucalypts, which we have planted so largely in South Africa. Australia and South Africa have, of course, practically identical climates, and most of the eucalypts grow rather better in South Africa than in Australia. This may be due to the fact that in South Africa they are in their own climate, and are at present free from the natural pests from which everything in nature suffers more or less. The Australian eucalypts in South Africa have all been raised from seed, and the importation of any green

[1] From an article contributed to the *Melbourne Argus* by the author.

parts of eucalypt trees is forbidden by law, so as to try to keep out the natural enemies that prey on them in Australia.

It is pleasant to note that among the various Australian States Victoria is easily first in forestry. I will go further, and say that in the sad history of forestry in Australia, Victoria has now definitely turned the black page, and placed its forests on the same footing as South Africa.

It is true that South Australia was the first in the field with scientific forestry in Australia, and that excellent work has been done, and is being done, in South Australia, but drought and want of funds have there placed limitations which happily do not exist in Victoria.

Western Australia, Queensland and Tasmania have, comparatively speaking, done as yet little to damage their splendid forest inheritance seriously. Queensland forestry should have a great future. It alone, among the Australian States, has a professionally-trained chief forest officer, and a good supply of softwood in its forests. Western Australia and Tasmania, through the want of forest demarcation 50 or 100 years ago, have got the existing forests into the wrong place (they are too inaccessible), but that can, to an extent, be remedied by planting the softwood forests of the future in the right place. This should be adjoining the towns, railways, or waterways, for the transport of farm produce costs less than timber and forest produce, while the cultivated forest, as an organic whole, produces yearly crops.

Of New South Wales forestry it is difficult to speak dispassionately, for there has been such an appalling destruction of forest, and purposeless waste of valuable timber under the plea of settlement. New South Wales is the oldest State, and it is to-day at the bottom of all the Australian States in forestry. It is situated in the centre of the habitat of the eucalypts, and has inherited the cream of the hardwood forests of Australia. But the best of these are gone, have passed away in smoke, under the name of "settlement," and no practical beginning has yet been made with the essentials of modern forestry—demarcation, planting, and the protection of the forests against fire and cattle, the A B C of modern forestry. The forests are under a dual system of management which precludes any attempt to evolve order out of chaos. A State cannot squander its natural resources, as New South Wales has done, without falling in the

comity of nations. When the truth gets out New South Wales will not be able to borrow in the world's money market on the same terms as Victoria. Forests are a valuable national asset. Germany gets a gross revenue of £15,000,000 a year from its forests; England is paying to-day £30,000,000 yearly for timber from abroad that might be grown two or three times over on its waste and poorer lands if they were under forest. New South Wales has what is pleasantly termed "an accumulated forest surplus of half a million"! That £500,000, wrung from the wreck of its forests, is going to cost New South Wales more than any money borrowed by any State in modern times. This I told the Minister in charge of forests in Sydney.

Doubtless there has been much weak sentiment over the destruction of forests in Australia. The greater part of the forest that has been destroyed had to go. It was required for settlement, and never had much value as forest. The mistake lay in the indiscriminate destruction of the forest. "Demarcate! demarcate!" said every scientifically-trained forester who has visited Australia during the last fifty years. But that has never been done, except in South Australia and recently in Victoria.

Before I came to Victoria I had heard of the destruction of forests that has taken place; the biggest trees in the world destroyed before any exact record of their size had been left to science, and only a remnant remaining where once the fine Otway forest existed. It was a keen pleasure to find on my arrival in Victoria that it had definitely turned this dark page in its history. Its remaining forests have been demarcated for the last five years. It has four million acres of State forest definitely set aside as national property, which is amply sufficient for all its needs, if only the forest were better placed and had more softwood. Victoria has a good Forest Act, and a live working Forest Department. An area of some 50,000 acres is fire-protected, and the area is being extended. Some remarkably economical planting of softwood is being done on French Island, and the State premier, in his forest pronouncement of 11th November last, said that from £6000 to £10,000 yearly would be spent in future on planting, at £3 per acre. The planting of softwood is actually being vigorously pushed forward, and every effort is being made to extend the considerable area of forest which is already protected from fire and unrestricted grazing.

The impression I have gathered in going through the forests in Victoria is that the authorities now, happily, have sufficient power to deal properly with the grazing question—a most important matter. In extra-tropical forests generally grazing is a good friend but a bad enemy. It is, of course, fatal among young trees, but assists fire-protection and revenue when the trees are grown up. Says the conservator of forests in his annual report for 1911: "The act passed by Parliament last session for the restriction of illegal grazing in forestry has so far been thoroughly effective." Of course grazing regulation and fire-protection go together, for a well-grazed, grown-up forest is safe from fire, and it is the graziers in extra-tropical countries who burn the forest to improve the grazing; and small blame to them as long as they do not forget the difference between *meum* and *tuum*. (In New South Wales, alas! the Forest Department may plant a tree, and the Lands Department turn on a cow to eat it up!)

Lastly, in Victoria, there is something of a sound public opinion on forestry matters. It is not often that the press of a country can point to a national mine of wealth saved to the country so largely through its instrumentality. With the capable staff of its well-organised Forest Department, forestry in Victoria should have a bright future. The one essential, a better provision of funds is now, I see by the newspapers, being provided by Government.

If I were asked what are the two ends to which these funds should principally be devoted, I should answer—(1) fire-protection, (2) the plantation of softwood.

One has only to go a short distance in the Victorian forests to see the mischief that has been caused by fire, and the loss still going on from it; and the opinion is commonly expressed that the protection of the forests from fire is a doubtful or impossible matter. That, however, is not so. Fire-protection in Victoria is not quite so difficult as in South Africa or round the Mediterranean, where the climates are similar, but with a longer dry season. Successful fire-protection in Victoria is simply a matter of organisation. There is no more difficulty with organisation in protecting any forest in Victoria than in protecting any house in the streets of Melbourne. But, of course, there must be organisation, and it will not pay to fire-protect inaccessible and comparatively valueless forests. It may be mentioned that for

successful protection of the forest three things are desirable :— 1. The watch-tower. 2. Fire-paths. 3. Extra watchers during the fire season. 2 and 3 have been in force for some years in Victorian forests.

Both South Australia and Victoria are doing good work in fire-protection, but want of funds has hitherto not allowed the initiation of the first, and most important measure, in either country. Without it fire-work must necessarily be incomplete and risky. The watch-tower is a feature in many Australian towns ; it is more necessary in the forest. In South Africa and in Southern Europe the forest watch-tower business has been carried out for many years. On Mont Vinaigre, in the South of France, I stood on a mountain some 3500 feet high, where was the chief watch-tower for the now completely fire-protected forest of Estarelle. The whole forest can be seen from Mont Vinaigre, and telephones extend from there to every part of the forest. The Estarelle forest some years ago was nearly burnt out. The local man said it could never be saved. It is to-day a conspicuous monument to the energy and enterprise of the French Forest Department.

The now successful fire-protection of the fine State forest of Leiria, in Portugal, has been achieved by means of four watch-towers. I visited this lately—only a few weeks before leaving for Australia. Pardé, the eminent French forest writer, describes the fire-protection of Leiria as perhaps the most remarkable in Europe. The forest here is a flat area near the coast, and four watch-towers are necessary. These watch-towers and all the forest stations are linked up by telephone. There has been no bad fire there for thirteen years.

In 1883, in South Africa, when the forests were organised, a forester was placed in charge of each of the more accessible valuable forests, and the fire watch-towers were economically planned by placing each forester on the highest point of his forest, or the point from where he could get the best view. He was given a comfortable home, with a good, substantial, generally stone-built house, and enough ground round his house for the purpose of a home farm. Near him, or at any rate within call, would be the forest nursery with its staff of labourers. Then, with the first whiff of smoke by day or the first spark of fire by night, there would be an alarm from the forest station, and the forester and his men would hurry off down hill to put

out the fire. A man can hurry down hill, and a forester wants no hurrying when he has the chance of scotching a forest fire at the outset! Of course, there is nothing in this except organisation. When a forest or a house is on fire the first essential is to be on to it without a moment's delay. But compare this with the present state of things. The forest may burn for several days before the forester, living at a distance, or at best in an adjoining town or village, knows anything about it. By then it may be uncontrollable. For as soon as a forest fire gets a good hold it creates a great upward rush of heated air, which feeds its own flames. Then the disaster becomes a national one. When some of the foresters in South Africa first went to the hilltops there was some grumbling from the wives. Why should they be called upon to forsake the fleshpots of Egypt and be buried in the clouds? Now they like their highland homes, and the rosy cheeks of the children show their healthiness.

Australia at this moment is spending about £10,000 per day on imported softwood. Statistics show that the cost of the timber imported to Australia, nearly all softwood, has now reached the alarming total of £3,500,000 yearly. And the figure is rapidly rising. Victoria spent £1,500,000 last year on imported timber (premier's speech, November 11). This was nearly all softwood. The most urgent necessity exists in Australia to follow the example of South Africa, and lay down plantations of softwood. Experience in South Africa has shown that some of the most valuable pine and other coniferous timbers can be planted with ease to produce timber equal in quality to the best of the imported Oregon and Baltic deal.

There is this feature, too, with reference to the planting of exotic softwood in the forests of Australia. Australia is an old-world land; for geological ages it has been cut off from the rest of the world, and the great struggle for existence and the survival of the fittest which has been going on in the flora and fauna of the rest of the globe has been absent in Australia. The result is that when any member of the stronger flora and fauna of the world, strengthened by the fight, gets into Australia it is liable to spread amazingly in its easy new home, provided, of course, the climatic conditions are suitable. This is a trite observation, but it is necessary to bring home my point. Rabbits, trout, various birds, and all sorts of weeds have spread and are spreading apace in Australia, but the forest world (which

they who know it feel is a world apart) lies almost untouched. The blackberry pest is creeping in as in South Africa, but where are all the valuable timbers of the extra-tropical regions of the world? Not yet introduced; and the white man has been over 100 years in the country! How has this curious position come about?

The average Englishman knows not forestry, and since he has been in Australia he has never taken the trouble to introduce the great range of valuable extra-tropical trees which might be introduced into the forest, with all the chance of their spreading naturally, as have the birds and the beasts and the fishes. What, then, should be done now practically to remedy this? The answer is—Organise the forests and do a little experimental planting in each forest. Along with the watch-tower system do a certain amount of planting. This would not cost much, but the experience gained would be invaluable. Not a day should be lost in doing it. It will soon be found out which trees are going away on their own account and enriching the forest. Two pines have become quite naturalised in South Africa; many others are becoming so.

The ordinary Australian forest is very deficient in softwood. At its northern limits, in Queensland, are valuable softwood forests; in the south, Tasmania has a small supply of its fine Huon pine, etc. But the ordinary Australian forest is as deficient in softwood as are the northern forests of the world in hardwood; and it is softwood that is wanted. Nine-tenths of all the wood used in the world is softwood, and people will have it, do what we may to push hardwood.

Along with a separate planting centre at each forest station there are wanted two or three national arboretums at Melbourne, Ballarat, Bendigo, and other centres. Only in this way can we prove exactly what is to be got out of the forest industry in Victoria. America has several arboretums; each country in Europe has them; and Japan, with its expenditure of £250,000 yearly on forests, has, naturally, not neglected them. Cape Town has a fine forest arboretum at Tokai; there are various other arboretums in South Africa. I recently made a study of the two national arboretums in the forest of Soignes, at Brussels (cf. pp. 1-14). (I pray that the devastation of war may have spared these). In Australia there does not exist one national arboretum. It is true that there are various small collections of trees, the best

of these being at Gosford in New South Wales, and at Macedon and Creswick in Victoria. The trees in the Botanic Gardens at Perth, Adelaide, Brisbane and Sydney are disappointing. This is inevitable, for they are gardens, not arboretums. Even in the unrivalled Botanic Garden of Sydney, the searcher for good specimens of extra-tropical trees looks in vain.

The one exception is the Melbourne Botanic Garden. It is larger than the others, and had a tree enthusiast to found it. Baron von Mueller came near to making a national arboretum; and when Mueller's work was transformed into the glorious garden we see to-day, a large part of Mueller's trees were left. The result is that, amidst all the beauty of the Melbourne garden, the student of extra-tropical trees finds there, at last, a study in trees which exists nowhere else in Australia, and, as far as I know, nowhere else within the extra-tropical climates of this globe. I came to Melbourne intending to stay three weeks; I stopped over two months, and it was mainly the Botanic Garden which kept me! There is a completeness and beauty in this garden which is marvellous.

I should like to see its usefulness extended by the introduction of the plan which has been followed with so much success at the British Museum, the National Gallery, and elsewhere in England—*i.e.* personally conducted tours. The Botanic Garden at Kew, near London, has now introduced personally conducted tours. The English climate does not permit Kew to have the variety of vegetation seen in the Melbourne garden. But the very wealth of species in the Melbourne Botanic Garden makes it necessary that some one who understands it should go round and explain it to the public. During the days which I have spent there with pencil and camera, questions have been addressed to me from which it was easy to see that not a fraction of the vegetative wealth was understood by the casual visitor.

One of the most valuable extra-tropical trees for introducing into Australian forests is the camphor tree (*Cinamommun camphora*). Its timber belongs to the most valuable class of timbers, the "durable softwoods." It bears abundant berries, of which birds are particularly fond and spread seed and young trees rapidly in the adjoining forest. This may now be seen going on at Gosford, in New South Wales. In a notice of this tree occurring in the annual report of the conservator of

forests, Victoria, for 1911 (page 17), he says:—"It (camphor) is suited to the warm, moist valleys of the north-east of Victoria." Camphor is required in the manufacture of explosives. Nearly all the present camphor forests are in Japan and Formosa, and a few years ago the Japanese nearly established a camphor monopoly. But other countries are now planting camphor. Australia should not only make plantations of camphor, but get trees planted here and there in glades in the fire-protected forests, whence later they can spread self-sown. Australia should surely be independent of foreign countries for its camphor.

His Excellency the Governor-General of Australia (the only English statesman who has more than a local knowledge of forestry) recently attended a conference on the question of forest education in Australia. And the question of forest education in Australia came up at one of the meetings of the botany section of the British Association. It is a want which must be supplied, sooner or later, because there are wide differences, both as regards theory and practice, between forestry in the sub-tropics, and forestry in either the tropics or in the cold temperate countries of Europe and North America. It is true that we have extra-tropical forest schools at Vallombrosa in Italy, at Madrid in Spain, the beginnings of a forest school in Portugal, and a marvellously complete system of forest education in Japan. But none of these countries quite represent Australian conditions, although Spain comes nearest to it.

The Madrid forest school, which I visited recently, I found surprisingly well equipped and ably conducted. Although Spanish is the easiest language in the world for an Englishman to learn, the language difficulty is a real one, and I doubt if many Australian forest students will ever go to Spain for their forest training.

When the South African forest school was established in 1905, it was hoped that a certain number of students of extra-tropical forestry might be attracted from Australia; but this did not happen, and it was soon found that the South African forest service was not in itself large enough to support a first-rate forest school. The men of the upper grades of the South African forest service now get their training as Rhodes' scholars at Oxford; but this, at best, is a temporary arrangement with obvious disadvantages. If a good federal school of extra-

tropical forestry were established in Australia, it would undoubtedly attract students from South Africa. Higher forest training is, of course, out of the question for one Australian State to attempt. The necessary equipment would be impossible for so small a number of students; but as soon as the remaining four Australian States follow the lead of Victoria and South Australia in forestry, a "Federal forest school of extra-tropical forestry" will become a necessity. The Creswick Forest School affords an excellent secondary forest training; and a similar forest school, but not so well equipped, exists in connection with the Adelaide University. For the secondary forest schools, it will be probably advantageous that they also some day should be federal. In France there is one forest school for the higher training at Nancy, and a very good secondary forest school at Barre, both of these being for the whole French forest service. (I might mention that my own forest training was done at Nancy.) South Africa has a good secondary forest school, on much the same lines as Creswick, at Tokai, near Cape Town.

In the course of my forest tours in Australia, I have been much struck with the fact that on the forestry question public opinion (Victoria excepted) was nearly absent. The man in the street does not realise that £10,000 per day is going out of the country for imported softwood, which could be grown in Australia as easily as it is now being grown in South Africa. Nor does he understand that the criminal waste of the hardwood will cost Australia in the end probably as much as the want of softwood. A rough calculation makes it probable that if Australia were to-day to embark on a sound system of scientific forestry, before sufficient softwood could be produced to meet the importation, and before the hardwood forest could be brought into a state of good productive and accessible forest, the loss to Australia will run into some four or five hundred millions—a figure which comes near to the total wealth won from Australian soil in gold and other minerals. This figure, according to the returns supplied to the British Association, amounts to £550,000,000. Scientific forestry is the most important social question Australia has to face. Each year brings some addition to the £10,000 a day now being lost. And that loss, too, not in a town industry, but in what should be one of the most important of the rural industries of Australia.

5. Durability of Timbers.

By Percy Groom.

Although our practical knowledge of the comparative durability of a number of familiar timbers is not inconsiderable, our detailed statistical information on the subject is exceedingly restricted. There is consequently not sufficient evidence available to permit of the formation of any reliable guiding principles in regard to the durability of woods, and we are dependent for any guidance upon merely empirical rules of limited application. Practical men have been familiar for centuries with the fact that sapwood and some light-coloured timbers are more perishable than coloured heart-woods, and for a long time must have known that darker samples are often more durable than lighter samples of one and the same timber. Hence very early in the history of the usage of wood must have come the idea that coloured woods are more durable than less deeply coloured or white woods, and that the deposit of colouring matter is associated with the increase of durability of wood. These familiar ideas have been transmuted into definite propositions, for instance on page 100 of volume v. of Schlich's *Manual of Forestry* (an English version of Gayer's *Forstbenutzung*). Here the following statement is made: "The presence of colouring matter in heart-wood, however, increases durability greatly." This statement is certainly premature; for even if it were universally true that more deeply coloured timber is more durable, and if the increased depth of colour were due to the deposit of colouring matter, the latter deposit and the increased durability may be two different results of one common cause. On the same page we also find written: "Mayr also states that *the more intense the colour of the heart-wood the more durable it is.*" This proposition old in idea, empirical in nature, and insufficiently tested by fact, is, by Professors Gayer and Mayr, styled "Mayr's Law": it is at most a hypothesis, and at present a mere rule of limited application. In support of it we find, on the same page of the volume cited, a list of timbers grouped according to depth of colour and in correspondence therewith described as "very durable," "durable," and "not durable," as the colour decreases in intensity. Yet the list is satisfactory from the point of view neither of gauging of colour nor of estimate of

durability: for instance, the wood of Douglas fir is described as being "very durable" and darker in colour than those of "pines," oak, and *Robinia Pseud-acacia* (commercially known in this country as "acacia"), which are grouped together as "durable." On the same page, it is frankly admitted that there are exceptions to the rule, and that the woods of two cypresses, holly and alder, are durable despite of their light colour.

But what are the facts? According to observations made in French coal-mines (and related in Mathey's *Exploitation Commerciale des Bois*), the following represents the order of durability of pit-props (beginning with the most and ending with the least durable) made of different woods: (1) oak, (2) Scots pine, (3) alder, (4) ash, (5) cluster pine, (6) *Robinia Pseud-acacia*, (7) willow, (8) maple and sycamore, (9) elm, (10) aspen, (11) cherry, (12) birch, (13) hornbeam, (14) beech, (15) poplar (not aspen). Not perfectly in accord but mainly so were the results obtained by R. Hartig with buried wood (heart-wood or its equivalent). He found: (*a*) *most durable*, larch, Scots pine and *Robinia Pseud-acacia*; (*b*) *less durable*, oak and elm; (*c*) *still less durable*, common silver fir and Norway spruce; (*d*) *least durable*, lime, birch, beech and poplar.

If we consider extra-European woods, some cases in opposition to the rule concerning depth of colour and durability are notorious. Some dark woods are by no means durable; for instance karri, rivalling jarrah in depth of colour and resembling it closely, is notoriously subject to fungal decay (popularly termed "dry rot"). On the other hand, the very light-coloured satinwood is extremely durable; I have myself seen satinwood stairs out of doors in London that are still sound after forty years of usage.

In order to obtain evidence of an unbiassed nature, I analysed the statistics given concerning the durability of Indian timbers in Troup's *Indian Forest Utilisation*. Troup ranges Indian woods into six classes according to their durabilities. Here I give the main results of my analysis of his first two and last two classes. In his class "*extremely durable*" are six woods, of which four are dark brown or dark red, one (teak) is brown, and the remaning one (*Fagraea fragrans*) is light coloured (light brown). In the next class, "*very durable*," are eighteen woods, of which six are certainly dark in colour, four are brown or reddish-brown (oak to mahogany in colour), one is light red

streaked with brown or black, another is rather light (oak) brown; and the remaining six definitely verge towards or are light in colour, two being olive-brown, one light red, one light brown, one (deodar cedar) light yellow-brown, and one (satin-wood) cream or light yellow. In the last two classes, "*slightly durable*" and "*perishable*," are included nine woods, all of which (with one possible but not probable exception) are light coloured. It will, therefore, be noted that among Indian timbers there is an increase in the percentage of light-coloured timbers with a decrease of durability, yet in detail the rule under discussion breaks down (as it does on more detailed examination of the woods of single Indian genera).

The conclusion to be drawn is that colour is no safe guide to the durability of wood, though the most perishable appear generally to be light coloured; for there are dark-coloured woods by no means durable, and light-coloured woods of exceeding durability.

This subject is one on which many members of the Royal Scottish Arboricultural Society could give and collect much valuable and needed information. The statistics supplied might be confined to cases in which the wood was exposed to air and water (fences, posts, exposed woodwork of buildings, timber in mines), and should include numerical details of the longevity of particular objects. In this connection examples of rapid rotting are quite as important as these of prolonged soundness. Very important would be particulars of the geographical position and exact situation and surroundings of the timber. It is in the hope of inducing such co-operative collation of information that this note is written. I shall be most grateful to any members who will be so good as to procure for me particulars concerning the durability of pit-props made of various woods, either untreated or treated with preservative liquids. The information might be sent to me at the Imperial College of Science and Technology, South Kensington, London, S.W.

6. The Great War.

THE SOCIETY'S ROLL OF HONOUR.

SECOND LIST. [1]

ADAM, Sir Charles Elphinstone, Bart. of Blairadam. Royal Naval Air Service.

ALEXANDER, John, Edinburgh. Motor Ambulance.

BAIRD, Andrew T., Poltalloch. Sergeant, 2/10 Royal Scots.

BROADFOOT, David, Forester, 185 Langley Old Hall, Langley, Huddersfield, Yorks. 1st 26 Provisional Aviation Attachment.

BROWN, Duncan, Foreman Forester, The Gardens, Birr Castle, King's Co., Ireland. Private, 8th Black Watch.

CACCIA, Anthony M., M.V.O., M.A.(Oxon.), Oxford. Major, General Staff.

COLSTON, William G., Rosemount, Lockerbie. 3/4 Cameron Highlanders.

COLTMAN, William Hew, of Blelack, Aberdeenshire. Major, 1/7 Gordon Highlanders (wounded).

COX, William Henry, of Snaigow. Lieutenant, T.F. Reserve, attached to 6th Royal Highlanders.

CURR, Thomas, Ninewar, Prestonkirk. 2nd Lieutenant, Highland Light Infantry.

DRYSDALE, Alexander, Assistant Forester, Parkend, Lydney, Glos. Private, 2nd Scots Guards.

FOWLER, George Ballantyne, Assistant Forester, Benmore. Corporal, 8th K.O.S.B.

FRASER-MACKENZIE, E. R. L., of Allangrange. Lieutenant, 1/1 Inverness R.H.A.

FRASER, Thomas, Assistant Forester, Dupplin, Perth. Orderly, V.A.D.

GALLOWAY, Robert Angus, Edinburgh. 2nd Lieutenant, 3/1 Field Coy. Lowland Divisional Royal Engineers (T.).

GLEN, James, Assistant Forester, Milton of Aberdalgie, Perth. Field Ambulance, Scottish Horse.

GRANT, Iain Robert James Murray, of Glenmoriston. Captain, 3rd Cameron Highlanders.

GRAY, David, Assistant Forester, Fairlie, Ayrshire. Private, 10th Black Watch (wounded).

[1] For first list see Vol. xxix. p. 192.

GREGORY, J. Charles, Gamekeeper-Forester, Granston Manor, Ballacolla, Queen's Co. 340 Coy. Mechanical Transport, A.S.C.

HECTOR, Thomas Gordon. On Military Service at Singapore.

HENDERSON, William, Assistant Forester, Benmore. Sergeant, 8th K.O.S.B.

HOOD, Thomas, jun., Egypt. 2nd Lieutenant, 3rd Suffolk Regiment.

IMRIE, Charles, Assistant Forester, Balgove, Rossie, Montrose. Lance-Sergeant, 2/5 Black Watch.

IMRIE, James, Forester, Aberpergrom Estate, Glen-neath, Glamorganshire. Sapper, 124 Field Company, R.E.

INGLIS, W. G., Edinburgh. Ambulance Service.

JACKSON, George Erskine, B.A.(Oxon.), W.S., Kirkbuddo. Captain, Fife and Forfar Yeomanry. Staff Captain, 1/1 Highland Mounted Brigade.

KETTLES, Alexander, Assistant Forester, Dupplin, Perth. Corporal, R.A.M.C., Scottish Horse.

LOGAN, David, Saltoun. Lieutenant, Army Service Corps.

LOVELACE, The Earl of, Captain, 11th Northumberland Fusiliers.

MACDONALD, Allan M., Apprentice Forester, Benmore. Lance-Corporal, 8th K.O.S.B.

M'DONALD, Frank Gordon M'Leod, Benmore Estates Office, Kilmun. 3/8 Argyll and Sutherland Highlanders.

MACDONALD, William, Assistant Forester, Dupplin, Perth. Corporal, 9th Seaforth Highlanders.

M'INTOSH, Donald J., Assistant Forester, Faskally Cottage, Pitlochry. C.Q.M.S., 6th Black Watch.

M'KENZIE, Kenneth D., Assistant Forester, Dupplin, Perth. Trooper, Scottish Horse.

MACKENZIE, Ralph James, Corstorphine. 2nd Lieut., 3/4 Royal Scots.

MACKENZIE, Robert, Assistant Forester, The Village, Dallas, Forres. 1/6 Seaforth Highlanders.

MACKENZIE, Simon John, Assistant Forester, Chatsworth. Lance-Corporal, 4th Cameron Highlanders.

MACKINTOSH, William R., Assistant Forester, Raith. Sergeant, Seaforth Highlanders.

MACKINTOSH, William, Assistant Forester, Thornbridge, Bakewell, Derby. Private, 4th Cameron Highlanders.

MICHIE, Henry M., Logan Estates Office, Chapel Rossan, Stranraer. Lieutenant, 1/1 Scottish Horse.

MILNE, Colonel George, of Logie. Royal Field Artillery.

MITCHELL, Charles, of Pallinsburn. Captain, Grenadier Guards.

MOFFAT, George, Assistant Forester, Hopetoun. 15th Divisional Cycle Corps.

MORISON, A. E. F., of Bognie, Mountblairy, Turriff. Captain, 3rd Gordon Highlanders.

NAYLOR, John Murray, Laighton Hall, Welshpool. Captain, London Rifle Brigade.

NEILSON, Walter Montgomerie, of Barcuple. 19th Service Battalion, Royal Fusiliers.

NEWLANDS, John, Assistant Forester, Raith. R.A.M.C.

OGILVIE, George Hamilton, Indian Forest Service. 2nd Lieutenant, Indian Army Reserve of Officers, attached 1/10 Gurkah Rifles.

PURVIS, Brigadier-General Alexander, St Andrews. Commanding Royal Artillery 35th Division.

RAE, Frederick S., Yair, Selkirk. Private, Scots Guards.

ROBB, Henry Grant, Forester, Knowsley, Lancs. Corporal, 10th Scottish Liverpool Regiment.

ROGERS, E. Percy, Estate Office, Stanage Park, Brampton Byran. Captain, 1/1 Herefordshire Regiment.

ROSS, Charles D. M., Factor, Abercairney, Crieff. S.Q.M.S., Army Service Corps, Remount Department.

SCOTT, William L., Assistant Forester, Douglas. Private, 14th Argyll and Sutherland Highlanders.

SMITH, J. Grant, Factor, Seafield Estates Office, Grantown-on-Spey. Lieutenant-Colonel, 1/6 Seaforth Highlanders.

SOMERVILLE, Hugh Christopher, 2 Fairhaven, Dalkeith. Sub-Lieutenant, Royal Naval Division.

STIRLING, J. A., of Kippendavie. Captain, 2nd Scots Guards.

STRATHARN, T. D., Kirkby, Lonsdale. 2nd Lieutenant, 3rd Yorkshire Regiment.

URQUHART, Angus, Inverness. Lieutenant, 4th Cameron Highlanders (killed).

WADDINGHAM, J. H., Grimsby. Lieut., 2nd Lincolnshire R.F.A.

WEIR, Andrew, H. W., Doonhome, Colinton. 2nd Lieutenant, 2/1 Lowland Brigade R.F.A.

YOUNG, William George, Estate Office, Craigielaw, Longniddry. 2nd Lieutenant, 3/8 Royal Scots.

7. *Sinodendron cylindricum*, L., and related Lamellicorns.

(*With Plate.*)

By R. Stewart MacDougall, M.A., D.Sc., F.R.S.E., Honorary Consulting Entomologist to the Society.

Sinodendron cylindricum is a rare beetle in Scotland, and the finding of it is worthy of record. The record is mentioned here, and a description given of the beetle and its larva, in order that Scottish foresters may be made familiar with the species which is, perhaps, not quite so rare as is believed.

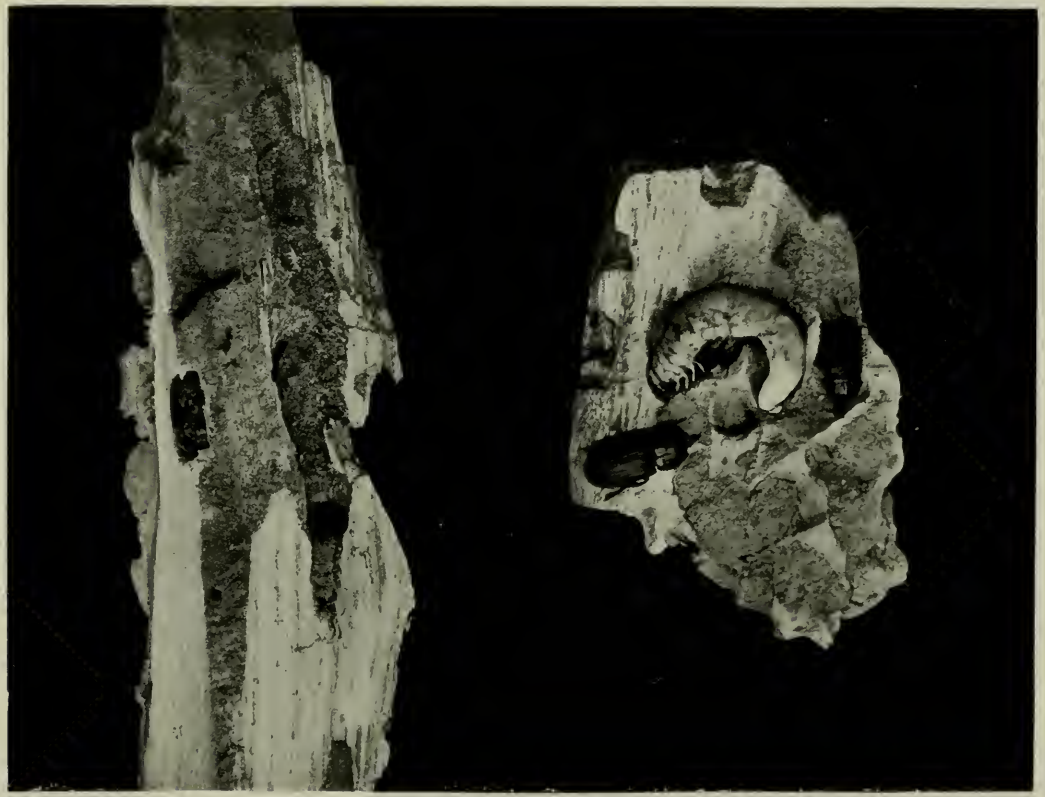
While searching in Peeblesshire for quite a different insect, on 7th October, with Mr James Munro, B.Sc., we came on a standing ash tree some 70 years of age and quite dead. The appearance of the bark and the wood exposed in places that had lost their bark, suggested that a closer examination might prove profitable from an entomologist's point of view. The outer portion of the exposed wood was in places so crumbly that these yielded easily to pressure with a chisel, and almost immediately Mr Munro exposed a large *Sinodendron* larva. A little further work exposed both an adult beetle and several larvæ. Permission to make still further and severer examination of the tree was given by the proprietor, and on a return visit on 23rd October a large number of *Sinodendron* larvæ and adults were got, these being taken from the trunk of the tree at a height from 4 to 10 feet. The trunk above this was left for future examination.

The larvæ were in all stages of growth, from quite small larvæ up to larvæ of full size like the one shown in Plate VI., Fig. 1*b*. The beetles, which were of both sexes, were quite fresh beetles. They had not yet made their exit into the open, but were lying where they had completed their development in chambers hollowed out in the wood; the more solid wood was hidden under a layer of powdery crumbled frass and sawdust. In this powdery material the fauna was a scavenger one—numerous slaters and millipedes and worms and scavenging mites all aiding to complete the reduction of the tree. Under loose and easily pulled-off sheets of bark there were numerous sheltering *Pollenia rudis* and *Cyrtoneura pabulorum*, two muscid species.

Not many yards away from this ash was an old elm tree that

PLATE VI.

[To face p. 50.



a *b*

FIGURE 1.

(*a*) Piece of Ash Wood showing galleries of *Sinodendron* larvæ; an adult beetle is also seen in the chamber where the larva had pupated.

(*b*) Piece of Ash Wood showing *Sinodendron* beetles and larva in situ.

The Figures are from Nature, and are natural size.

a *b* *c*

FIGURE 2.

(*a*) Larva of *Dorcus parallelipipedus*; the larva has not reached its full size.
(*b*) Larva of *Lucanus cervus*.
(*c*) Larva of *Melolontha vulgaris*.

All from Nature.

had broken across a foot or two from the base of the trunk. This tree was also dead, and showed the fructifications of a fungus projecting from it. Examination of the trunk 7 or 8 feet up yielded, like the ash, young *Sinodendron* larvæ, older larvæ, and beetles. This ash and elm with their decaying wood were typical habitats for *Sinodendron*, which, in addition, has been taken from oak, beech and willow.

Sinodendron cylindricum.

The adult beetle (see Fig. 1) varies in length from one-third to about half an inch; colour black; shape elongated and rounded; head small and punctured having on its upper surface, in the case of the male, a recurved horn which has yellow hairs adorning its upper hind portion (use a lens), and in the female a smaller horn or projection unadorned. The mandibles of the male *Sinodendron* are not large and exposed as they are in its two relatives *Lucanus* and *Dorcus* mentioned below. The thorax is shining black and punctured, and is hollowed out in front; on the front edge at the top of the hollow (use a lens) are three teeth, more pronounced in the male than in the female. The wing-covers show longitudinal lines and rows of punctures, the punctures on each side of the suture being smaller.

The antennæ, the palps of the mouth, and the tarsi of the legs are vinous red in the quite fresh beetle, but become darker red.

The Larva.—The larva is a typical Lamellicorn larva with a brown head and well-marked gnawing mouth-parts; the head carries a pair of small antennæ (use a lens) but no eyes. The body is fleshy and curled, and in colour is dirty white or white-yellow. A very marked difference between the *Sinodendron* larva and the larva of the cockchafer is that while in the latter the last segment of the abdomen is very large and swollen, in *Sinodendron* the last segment is not swollen, but the hinder part of the body is narrower than the front part; this is brought out in Fig. 1*b*. The thorax carries three pairs of legs, and these end in a tube-like process seen, under a low power of the microscope, to be armed at the apex with three spines, a smaller central one and a longer one on each side.

On the upper surface of the first segment behind the head there is a yellow horny patch on each side of the middle line, two similar but much smaller patches on the next ring, and still smaller ones on the third ring. If the larva be laid on its back

a brown-yellow line is seen to run from each side of the head down the first segment.

By aid of a lens a spiracle is seen on each side of the first segment, and spiracles on body-rings 4 to 11 inclusive. Very characteristic is the view of the hind face of the last segment of the body (using a lens); the anal vent is longitudinal in direction, and is flanked on each side by a bulging oval lobe, while above there is a small lobe.

Dorcus parallelipipedus, L.

This beetle is very close in relationship to *Sinodendron* and *Lucanus* (the stag-horned beetle). It has similar habits, and is found in broken and decaying stems of ash and elm. It does not occur in Scotland. In January 1914 a member of the Royal Scottish Arboricultural Society sent me, from Lincolnshire, *Dorcus* and its larvæ taken "in large numbers in the decayed heart of an old ash tree." Along with them were found specimens of the ground beetle, *Pterostichus vulgaris*. Again, in July of this year, Mr Charles Bruce, another of our members, sent me from Oxfordshire for determination a handsome live *Dorcus* taken from a somewhat decayed walnut tree.

Lamellicorn Beetles.

As an assistance to others who may meet with these species, I give below the chief characters of the division of beetles[1] to which *Lucanus* and *Dorcus* and *Sinodendron* belong, and of their larvæ.[2] In the key to the larvæ I include some allied species likely to be met with and to be confused.

Lamellicornia is a division of beetles characterised by a five-jointed tarsus; antennæ kneed or slightly kneed, with the basal joint long or thickened; the end joints of the antennæ broadened out on one side to form a sort of club; these extensions of the antennæ are leaf-like or fan-like or comb-like, and in many species can be spread out or brought close

[1] For a detailed classification of the adult beetles, the reader is referred to Fowler's *Coleoptera*, vol. iv. page 4.

[2] In drawing up the key for the larvæ, I have been greatly indebted to Perris's *Larves de Coleopteres* and to Schiödte's *De Metamorphosi eleutheratorum observationes*, adapting their descriptions with slight additions after comparison of specimens of the larvæ.

together at will; in a small number of species the movement of the leaves of the antennæ is limited or absent.

There are two Families of Lamellicornia, viz. Lucanidæ and Scarabæidæ, distinguished thus:—

LUCANIDÆ (the Stag-Horned Beetles).

Antennæ distinctly kneed, comb-like at the apex; the apical extensions of the antennæ cannot be brought close together. On the underside of the abdomen 5 sternites can be counted.

SCARABÆIDÆ (the Chafers).

Antennæ scarcely kneed; the leaf-life extensions at the apex can be separated and brought together like the leaves of a book or like a fan; on the under surface of the abdomen 6 sternites can be counted.

Family LUCANIDÆ.

Key to the three British Genera.

A. Eyes more or less divided by a groove or channel on the side of the head; antennæ kneed.

1. The tibiæ of the front legs are without grooves or channels (use a lens) on the upper surface (*Lucanus cervus*).[1] The larvæ of *L. cervus* live in the stems and roots of decaying broad-leaved trees, *e.g.* Cupuliferæ and ash.

2. The tibiæ of the front legs have several grooves on their upper surface (*Dorcus parallelipipedus*).

B. Eyes not divided; antennæ straight; head with a small horn (*Sinodendron cylindricum*).

Key for Larvæ.

In this key, in addition to the Lucanidæ larvæ, I include the larvæ of three beetles of the Family Scarabæidæ which the forester may find, and which are the likeliest to be confused with the Lucanid species, viz. *Melolontha vulgaris*, the cockchafer, *Cetonia aurata*, the green rose chafer, and *Gnorimus nobilis*. The larva of the cockchafer does not live in galleries

[1] In July 1909 one of our members, Mr James M'Callum, sent me this beetle for determination, from Dorset. Mr M'Callum found the beetle on the road.

made in a tree, but is found at the roots of conifers and broad-leaved species in nurseries, as well as at the roots of grasses.

The larva of *Cetonia aurata*, besides being found feeding externally at the roots of plants and sometimes in the nests of the ant *Formica rufa*, can also be found feeding in the rotten wood of decaying stumps.

The larva of *Gnorimus nobilis* feeds in the stems of decaying or fungus-attacked cherry trees. *Gnorimus nobilis* is a rare beetle, but some years ago I had sent to me from Buckinghamshire a section of the stem of a cherry which contained the grubs of this beetle. The grubs were tunnelling in the wood which had previously been attacked by fungi; nearly twenty adults were bred out from this log which was about 2 feet long.

Different characters may be chosen in order to separate the larvæ (Fig. 2) from one another. Quite a good character for separating the two Families is the direction of the anal slit. By the aid of an ordinary hand-lens examine the hind face of the last segment of the larva and note—

1. The anal slit lies in the longitudinal direction (the Family Lucanidæ).
2. The anal slit lies in the transverse direction (the Family Scarabæidæ).

Schiödte divides the two Families according to the nature of the stridulating organ. These Lamellicorn larvæ are able to make a noise, due to the rubbing of one part of the body against another (stridulation); the parts brought into play in the rubbing are known as the stridulating organs. The position of the stridulating apparatus varies in the two Families, thus:—

1. The stridulating organ is a grooved surface on the under side of the basal joint of the last pair of legs; over this surface there rubs a tooth-like border on the basal joint of the middle pair of legs (Family Lucanidæ).
2. The stridulating organ is on the mandibles as an oval grooved space over which there rub teeth situated on the underside of the maxillæ (Family Scarabæidæ).

This distinction is a serviceable one, but the legs in the one Family and the mandibles in the other should be dissected away for examination under a low power of the microscope.

Another excellent character for the separation of the larvæ is the nature of the upper surface of the abdomen, viz., whether

the skin shows several folds to each segment or none. Help can also be got by a close examination of the spiracles, the low power of a microscope being required for certainty. The spiracles are nine in number along each side, viz., on the first segment behind the head and then on segments 4 to 11 inclusive. The spiracles are somewhat C-shaped, and their border is brown-red in colour. Attention should be directed to the way in which the C of the spiracles lies, whether the open part is towards the head or facing the hind end.

The number of joints to the antennæ should be observed. There is slight confusion in the literature because some authors do not include a basal joint as part of the antenna, but look upon it as a process from which the antenna springs. In the key which follows I include this so-called process as the lowest joint of the antenna.

These various characters may be worked into the key thus:—

A.—Abdominal segments without transverse folds on their upper surface . . . . *Lucanidæ.*

I.—Antennæ 5-jointed; the open side of the C-shaped spiracles faces the head end of the larva.

(*a*) Mandibles and labrum rough—*Lucanus.*

(*b*) Mandibles and labrum smooth and dimpled—*Dorcus.*

II.—Antennæ 4-jointed; the open side of the C spiracle on the first segment after the head is directed towards the hind end of the larva; in all the other spiracles it is directed towards the head end—*Sinodendron.*

B.—The abdominal segments (except the two last segments) have transverse folds on their upper surface; the open side of the C-shaped spiracle of the first segment after the head is directed to the hind end of the larva; in all the other spiracles it is directed towards the head . . . . *Scarabæidæ.*

I.—Last segment of abdomen divided into two by an annular groove—*Melolontha.*

II.—Last segment large and undivided; labrum 3-lobed; claws of feet replaced by a somewhat long plump appendage—*Cetonia.*

III.—Last segment divided but only on the upper surface; labrum not 3-lobed; feet end in a claw—*Gnorimus.*

8. Polyporus Schweinitzii, Fr.[1]

(With Plate.)

By J. M. Murray, B.Sc.(Agr.), B.Sc.(For.).

This fungus has been known on the Continent for many years as an enemy of Scots pine, Weymouth pine and larch, but has not been considered to be a serious enemy. In the United States it is common throughout the northern forests of spruce and fir, and is said to be one of the most destructive of Polypori. There, it is recorded as attacking the white and red spruces, Balsam firs, *Thujas*, and Weymouth pine. In Britain *P. Schweinitzii* has hitherto been regarded as a rare species. It would seem to be becoming much more common, however, and may yet have to be regarded as a great danger to coniferous forests. I have found it attacking Douglas fir and Sitka spruce in Perthshire, and Scots pine in Midlothian. It has also been recorded on larch in England.

The fructifications are large and easily recognised (Plate VII.). They appear from July to October and may occur in two forms. When springing from a level surface they are usually circular, plano-concave, and may consist of several tiers supported by a short, stout, central stalk. When springing from an upright matrix the pileus may be almost sessile and bracket-like. On their first appearance the sporophores are soft, cushion-like, and brownish-yellow in colour. When mature they become dark brown and velvety above, with darker and lighter zones alternating so that the pileus has a ringed appearance. The margin is usually greyish, or tawny white for a time, but ultimately the whole becomes dark brown. The interior of each sporophore is warm brown and spongy-fibrous.

The hymenial layer is greenish-brown and quickly changes to dark red on being bruised. The pores are rather large and irregular in outline. Large white or yellow spores are produced in large numbers on basidia with which are intermixed various forms of hairs.

The presence of the fungus may be indicated first by the appearance of one or more sporophores at a short distance from the tree stem. These arise from a mycelium living on

[1] *Polyporus mollis*, Fr., of R. Hartig in *Zersetzungserscheinungen des Holzes.*; *P. mollis*, Pers.; *P. sistotremoides*, Alb. et Schw.

HOLLOW BUTT AND STOOL OF LARGE SITKA SPRUCE, SHOWING FRUCTIFICATIONS OF P. SCHWEINITZII.

SELECTING TELEGRAPH POLES IN THE FOREST OF ENZIE.
(*See p.* 60.)

roots which are comparatively near the surface of the ground. Evidently the fungus first attacks the roots and then gradually works upwards into the trunk. There it spreads, causing decay in the stem which has been known to reach a height of 40 to 50 feet.

The rot produced is rather characteristic. At first the wood becomes dull yellow, later it changes to dark brown. Here and there small white patches or pockets of mycelium may be seen. The whole mass becomes brittle, very light, and is broken up by many fissures. Occasionally, the sides of the fissures are coated with a thin, chalky, non-branching mycelium. Spiral cracks and fissures, said to be due to the drying and shrinkage of the wall substance, make their appearance in the tracheids. The decaying wood has a turpentine-like odour.

The rate at which the fungus progresses seems to be variable. About six years ago a large Sitka spruce first produced sporophores at a few feet from the base of the trunk. To outward appearance the tree remained healthy till it was broken over by wind two years ago. The outer wood, to about 6 or 8 inches in width, was then found to be the only sound part in a butt 3 feet in diameter at breast-height. About 18 feet of the stem showed more or less distinct signs of rot.

A Douglas fir bore one fructification eleven years ago Other single ones came up in the next two years, and since then none have appeared. This may or may not mean that the fungus is now dead. At present other attacked Douglas firs are under observation, and on some of these, large and apparently vigorous sporophores have been produced for several years. As yet I have not seen the wood of an affected Douglas fir, and therefore cannot say what the effect of the fungus is on it.

The following remedial and preventive measures might be suggested:—(1) Cut off affected roots well above the place where the last sign of rot appears, and tar the wound; (2) Collect and burn sporophores while young; (3) Cut out badly attacked trees and plant hardwoods in their places.

NOTES AND QUERIES.

Afforestation of Waste Lands in Denmark.

Lt.-Col. Martin-Martin writes from Skye calling attention to an interesting article by Mr James Baker, which appears in *The Outlook* for 28th August last, from which we take the following extracts:—

"Shortly after the war[1] a few men, led by Mr Mourier Petersen, Mr Hagemann, Colonel Dalgas, and Mr Morville, founded a society "Det Danske Hedeskab" (the Danish Heaths Society), and the aim of this society was to develop the planting of trees on sand wastes and districts useless for other cultivation; to plant hedges and create wind shelters; to cultivate marshes, bogs, and other waste lands; to develop and assist the transport of chalk and lime into districts devoid of these necessary products, and in general to assist reclamation of waste districts. The work commenced in Jutland, but now spreads over all Denmark, and the King since its foundation has been a patron and takes an active interest in the work.

"The present president of the society is Count Luttichau, and the chairman of the committee Mr Dalgas, son of Colonel Dalgas, both of whom I had the pleasure of meeting on the occasion of the society's annual inspection of some of their work, just before the war broke out, in June 1914.

"The whole visit was intensely interesting, but perhaps more exciting and even weirdly interesting was a visit to the Sahara, a shifting-sand district near Skagen. Near this the work is going on of cultivating these restless sands, but this Sahara is to be kept as a show place, and wild and strange as the African desert it is, but of a whiter, finer sand.

"We passed through miles of State fir plantations, and then on to the sands and were shown the Marehalm, the first grass that is planted, with running roots 4 to 5 yards long and

[1] The war meant is that between Prussia and Denmark which ended in 1864.

having a corn-like ear. Another grass that is used to bind the sand and keep it still is the Klittag—*i.e.* Klit, meaning dune, and Tag, meaning deck or roof of the dunes. These grasses give a protection of about a foot, and behind this can be planted the Bjergfyr or hill fir, that will grow to about 4 or 6 feet in height; and then behind these can be planted another fir that will grow to 20 or 30 feet, and all this material, even from the smaller firs, is utilised. Marvellously wild and beautiful was the scene when we were lost as it were amidst the sea of hills of shifting silver sand, and a strange contrast to come into the cultured tract; between the plantations in the marshes were vast quantities of lovely wild flowers, especially the *Pyrola major*, and in a thicket of young firs we came upon great masses of deep blue lupins; these are grown, and buried in the soil for their chemical properties.

"We went on to a little village where was a quaint, delightful little inn, known as the Kokholm, all spotlessly clean. Here we heard the wages were four kroners a day and food found—*i.e.* 4s. 8d. per day. Compare this with the wages our farmers cannot afford to pay, because of the lack of scientific knowledge and organisation. Denmark can pay these wages, and cut out English produce, until we educate our farm-lads scientifically and make agriculture and forestry the most delightful and also most profitable life, and thus banish from our foolish sayings, 'The dulness of country life.'"

Col. Martin goes on to say:—

"Personally I am most interested in forestry as affecting the Western Highlands—and even more especially the Islands; and the need of forestry is most urgent in these parts to arrest total depopulation.

"The article quoted has much which is applicable to our special needs, *e.g.* the sand dunes occur also with us in many places, such as in Coll and others of the outer isles; and the Danish methods of tree-planting appear apposite both as to grasses to bind the dunes and the wind shelter of scrub firs, called Bjergfyr in Denmark.

"The scale of agricultural wages (higher than industrial ones) is of course a desideratum for all rural industries, but would need to be considerable in Britain to overtop the 8s. 3d. obtainable in a coal mine!

The Selecting of Telegraph Poles in the Forest of Enzie.

In connection with the article on this subject which appears in Vol. xxix. p. 141, we publish here a photograph of the actual process of selection in the woods. (Plate VII., opposite p. 56.)

The Collection of Forest Seed.

The question of the collection of the seed of forest trees is becoming important in this country, so that it is interesting to note the steps taken by the Government of the U.S.A. to obtain seed in the forests on the slopes of the Rocky Mountains and Coast Ranges. The seed is required for the re-stocking of the forest lands farther east which have been devastated in the States, the quantity of seed handled by all the commercial houses of the United States being quite inadequate for this purpose. In *The County Gentleman*, Mr T. W. Venemann gives some account of the methods adopted, and from his article we extract the following :—

"To appreciate the importance of this seed-collecting industry one needs but to visit any of the several seed-extracting plants in the national forests. For example, at Idlewild, in the Arapahoe National Forest of Colorado, half a day's journey from Denver, is located one of the most completely equipped plants in the country. Thousands of bushels of pine cones, gathered by the settlers in that vicinity, are delivered there to the United States Forest Service to make up the supply of lodgepole pine seed used annually in re-foresting the burned and denuded areas within the Colorado and Wyoming forests.

"Beginning about the middle of September, or as soon as heavy frosts set in, men, women and children are off to the forests in search of pine cones. A good seed year makes their task a comparatively easy one, because the squirrels cover the ground with cones. Round every tree, in every hollow and cranny, under every old log, the cones are piled. The squirrels, but temporarily interrupted, soon retrieve their losses.

"At the extracting plant the Government pays for cones at the rate of forty to fifty cents a bushel.

"Of the coniferous species common to the Rocky Mountain

forests, the lodgepole pine seed is said to be the most difficult to extract. Unlike the yellow pine, Douglas fir, and Engelmann spruce cones, which under favourable weather conditions may be opened by spreading them on large canvas sheets in the sun, the lodgepole pine cone, because of its small size and other characteristics, may be opened to advantage only by artificial heat. Therefore the plant at Idlewild, located in a great lodgepole forest, is used almost exclusively for extracting the seed of the lodgepole pine.

"This plant consists of a large storehouse, a furnace room, and an extracting and cleaning room. The storehouse is a series of large bins in which the "green" cones are stored while awaiting seed extraction.

"In order to prevent mould and mildew from injuring the cones the house is built of slatting so arranged as to keep out rain and snow, and at the same time permit of maximum ventilation. Auxiliary pipes are also run through each bin to increase the circulation of air. The furnace supplies the necessary heat for opening the cones.

"Unquestionably the most interesting feature of the plant is the extracting and cleaning room, which is located above the furnace and contains a large drying kiln, a cylinder shaker or drum, a wing crusher and a fanning mill. In the process of extracting the seed the "green" cones are spread in thin layers on tiers of screen-bottomed trays. These trays, loaded on a movable platform, are slid into the kiln, which is heated to a uniform temperature of about 140 degrees Fahrenheit. The cones are left in this heat for six to eight hours. On removal the cones will be sufficiently open for the extraction of the seed. They are placed in the drum, which is covered with a close-meshed screen, and by rapid revolutions the seed is shaken free from the cones and drops through the meshes on to a canvas sheet spread beneath, while the empty cones are forced through the lower end of the slightly inclined drum and fall into the furnace room below, where they furnish practically enough fuel to operate the plant.

The seed is next run through a mechanical cleaner or crusher, which removes the wings characteristic of the seed of nearly all the coniferous species. This crusher is a circular table rotating under several stiff brushes that separate the wings from the seed.

"Up to this stage the seed has been mixed with broken cone

scales and needles, chaff, resin, and other debris. So it must undergo one more operation, which consists in running it through the fanning mill. The clean seed is stored in large air-tight cans, ready to be shipped to the various localities in the national forests in need of re-stocking with lodgepole pines.

"Approximately one hundred bushels of cones are cleaned every twenty-four hours during the extracting process. Three bushels of lodgepole pine cones are usually required to produce one pound of clean seed. A bushel of Douglas fir cones may yield one pound of seed; a bushel of yellow pine cones one and a half pound of seed; and a bushel of white fir cones four and a half pounds of seed."

Snapping of Elm Branches.

A lady in Essex writes to me as follows:—"All this summer large limbs have been falling off the elm trees here, for no apparent reason, and with no sort of warning. It is most dangerous. The same thing has been happening to the cedars, which must be 1000 (*sic*) years old, I suppose. It is so sad to see them go; can any one explain it?" I am unable to offer any explanation. Can any of your readers give me one?

W. M. Price.

Douglas Fir (*Pseudotsuga Douglasii*) in Banffshire.

It may be of interest to members of the Royal Scottish Arboricultural Society to read the following notes of five Douglas firs that were cut recently at Forglen House, the property of Sir G. W. Abercromby, Bart. of Birkenboy and Forglen.

The firs were planted about forty-seven years ago, according to the annual rings on the roots. It was found necessary to have them removed, as they had been planted quite close to a stone and rail fence around the mausoleum, and the swelling of the roots were damaging the fence.

The trees were not, from a silvicultural point of view, marketable timber, as they were practically heavily branched to the ground, and the timber produced was very knotty.

As will be seen in the column of total heights two of the trees were much shorter than the others. Some time ago they suffered

from storms and were practically staghorn-headed, and tapered very much in the trunk. They were cut into lengths averaging 8 feet, and each tree throughout showed a great amount of red heartwood, which seemed to darken on exposure to the air. It is proposed to convert the trees, at the estate sawmill, into planking for steadings, 2 ins. and 1½ in. trevicing.

The Douglas fir at Forglen, even in a young stage, has proved itself of greater durability than Scots pine for fencing purposes.

	Total Height	Girth at 5 feet from ground	Girth at 10 feet from ground	Girth at 20 feet from ground	Girth at 30 feet from ground	Girth at 35 feet from ground	Girth at 45 feet from ground
	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.
No. 1	53 7	7 4	...	...	...	...	...
,, 2	69 0	6 4	5 9	5 1	4 7	...	...
,, 3	52 8	8 9	7 10	5 9	4 9	...	...
,, 4	65 4	7 7	7 2	6 9	...	3 9	...
,, 5	68 7	6 9½	6 7	5 6	4 3½	...	2 7½

JAMES M'HARDY.

HEIGHT-GROWTH IN CONIFERS COMPARED.

In a previous number of the *Transactions* I gave some particulars of tree-growth, since then I have made periodical measurements of conifers growing on a fairly good forest soil, planted in 1908, partly in groups and partly mixed. The average height over the entire plantation is about 10 feet. I give below the figures for two growing seasons. The measurements described were taken from trees that had made a normal growth the previous season, different trees being selected each year. One of each variety only was measured, the selected tree being specially marked at the beginning of the growing season.

I don't know if it is generally realised that Scots pine has nearly finished its season's growth before the larch begins to grow.

It will be noted that the Scots pine made practically all its growth in May and June; the Insignis pine, May to July; *Pinus Pinaster*, May to September; Douglas fir, May to October; European and Japanese larches, June to September. A close study of the table overleaf suggests some serious thoughts

to those who mix these conifers lightheartedly, but I am not going to start a discussion on "that" subject.

	1914			
Variety	May 21	June 21	July 21	Aug. 21
	Ins.	Ins.	Ins.	Ins.
Scots Pine	19	30	31	31
Insignis Pine	19	36	49	50
Pinaster ,,	18	29¼	34½	36
Douglas Fir	8½	27	39½	44
European Larch	3½	17	25	38
Japanese ,,	3½	15	29	37

	1915						
Variety	May 6	May 21	June 21	July 21	Aug. 21	Sept. 21	Oct. 21
	Ins.	Ins	Ins.	Ins.	Ins.	Ins.	Ins.
Scots Pine	6	16	32	33	33	33	33
Insignis Pine	4	17	27	38	45	45	45
Pinaster ,,	7	12	24	31	36	37	37
Douglas Fir	...	3	18	33½	43	49½	50
European Larch	...	...	11½	20½	31	35¾	35¾
Japanese ,,	...	...	8½	18	30½	35¾	35¾

JAS. M'CALLUM.

FORESTRY IN AUSTRALIA.

That the Society's former Honorary Secretary has not lost interest in forestry matters by his transference to a new sphere of work is well shown by the following, taken from the *Scotsman* of 17th November last:—

"Sir Ronald Munro Ferguson's deep and practical interest in afforestation in this country is recalled by a speech which he made on the occasion of his first official visit to South Australia as Governor-General. He inspected the State forest reserve at Kuitpo, twenty-nine miles south of Adelaide, and in the course of a speech he said:—'I have been much impressed with the variety of the hardwoods grown in Australia. They are really wonderful, and I believe that here in Australia you have a larger variety of the best hardwoods than exist in any other country in the world, but the trouble is that they have been wasted to a large extent. By that I mean that in many instances these

hardwoods have been used when cheaper and softer timber would answer the same purposes, such as in making fruit cases, for instance. Yesterday I saw the pine plantations at the Kuitpo Forest beyond Clarendon, and the trees were growing splendidly. This country has another advantage in timber-growing—a forest matures in thirty years, whereas it takes sixty years to reach the same stage of maturity in Europe. Then, the Californian pine grows splendidly here, while it will not grow at all in the north of the British Isles. This is a very useful variety of timber for many purposes. The people should realise that practically all the timber now imported from the Baltic, Canada, and Japan can be grown equally well here. And here in Australia, with its 3,000,000 of square miles, there is no lack of elbow room.'

"The total area reserved for forests in South Australia, on 30th June 1914, was 154,232 acres, and, besides gradually adding to the reserves, the Government have established a School of Forestry at the Adelaide University for the scientific training of foresters."

Home Nursery.

The advantages of a home nursery are too well known to need much comment. The plants raised in these nurseries are more acclimatised, better rooted, and not so lanky as a rule as plants brought from a public nursery. The public nurseryman aims at securing height at the expense of root formation, and there are generally more failures among them than among the home nursery plants. If carried on in the proper manner the home nursery can be made a most profitable concern, and will quite repay all the trouble taken over it. Geo. Mowat.

Rubbish in Woods.

Prunings, decayed and discarded branches, should never be left lying about in young woods, but should be gathered up and burnt. There will then be less insect and fungus disease to contend with, and the young wood will not only be in a more vigorous and healthy condition, but have a much better appearance, and at the same time will sell to more advantage.

Geo. Mowat.

Black Game.

In some places these are found very troublesome, owing to their fondness for young Scots pine buds. They seem to be hardest on them when the trees are first planted out, as they then invariably peck out the leading bud, and thereby give the young tree the appearance of a bush more than a tree. A good preventive is to smear the leading buds with a mixture of archangel tar and tallow, this being done before the plants leave the nursery, and continued for a year or two afterwards, until the leader gets beyond the reach of the birds. Let them pick the buds out of the side branches by all means, for the writer has an idea that this is beneficial, rather than otherwise, as it may force or induce the young plant to put more vigour into the leading shoot. Geo. Mowat.

REVIEWS AND NOTICES OF BOOKS.

The Artistic Anatomy of Trees: Their Structure and Treatment in Painting. By Rex Vicat Cole. Illustrated by 50 examples of pictures from the time of the early Italian artists to the present day, and 165 drawings by the author, supplemented by 300 diagrams in the text. xv + 347 pp. Price 7s. 6d. net. London: Seeley, Service & Co., 1916.

This book is written primarily for artists, but foresters and all tree-lovers will find it interesting, and will be charmed by the beautiful drawings of trees and parts of trees. The volume is divided into three parts, which are entitled, "Trees considered in Relation to Painting," "The Anatomy of a Tree," "The Details of Trees." The first part is illustrated by a number of reproductions of famous pictures, as well as by drawings and diagrams, and makes its primary appeal to the art student. On the other hand, the two following parts give a large amount of botanical detail, arranged in a simple fashion, and illustrated in a way which the botanist can rarely emulate. Further, Mr Cole's special purpose leads him to consider leaves, twigs and buds with a loving care which the older type of botanist in the general case only gives to parts which are of value in classification. Such points as the

difference in appearance and position between young and old leaves, between upright shoots, *e.g.* in the thorn tree, and arrested twigs, the question whether the whole of the blade of a leaf lies in one plane, as in the case of the alder, or in more than one, as in the case of the elm, are discussed and illustrated in the most delightful fashion, and those who have watched trees through the changing seasons have the pleasing experience of finding here their half-unconscious observations formulated and illustrated. Such a sentence as—"The holly leaf attracts attention by its many diverse planes, with the consequent power of reflecting different lights on the same leaf," for example, calls up at once pictures of the bushes as seen on a winter's day with their innumerable tiny mirrors gleaming in the pale sunlight, while some of the drawings of twigs in first leaf contain the very essence of the spring.

There is a useful classified bibliography, botanical and general works being distinguished. We recommend the book to the notice of all lovers of trees.

Insects and Man. An account of the more important, harmful, and beneficial insects, their habits and life-histories, being an introduction to Economic Entomology for students and general readers. Illustrated with drawings and reproductions from photographs. By C. A. Ealand, M.A. Price 12s. London: Grant Richards, Ltd., 1915.

In the Introduction, which gives a general statement regarding the importance of insects from the economic standpoint, the author disclaims the credit due to research workers in Entomology, and modestly describes his book as "an attempt to compile in non-technical language a concise summary of the varied relations of insects and man." The result, representing much reading and much searching of the literature, is a very readable and serviceable book. At a time when, more than ever, insects are pressing themselves on man's notice in conveying disease and in destruction of his stock and his crops, this book should secure readers. The insect world is so vast, and the relationship between insects and man so complex, that Mr Ealand has had to choose outstanding examples in his various chapters, and the selection has been well made.

Of insects that have proved extremely harmful to plants

Mr Ealand describes the Gipsy Moth, San Jose Scale, Hessian Fly, Mediterranean Fruit Fly, and Vine Phylloxera.

In the chapter "Insects and Human Disease"—a branch of Entomology in which British workers hold a high and very honourable place—the author mentions Mosquitoes and Malaria, Yellow Fever and Stegomyia, Tsetse Flies and Sleeping Sickness, Phlebotomus and Three-Day Fever, the Flea and Plague, and also Ticks. Then diseases of stock, as related to Insects and Arachnids, receive attention, and there are other chapters on Beneficial Insects, Insect Pests in Houses and Insect Control.

Mr Ealand covers in this book a wide field, and certainly succeeds not only in conveying a mass of interesting general information but also in impressing the reader with the very important part which insects play in relation to man. The book can be cordially recommended. The Class Insecta is one of the dominant Classes of animals, and by adaptation to environment insects have very successfully solved for themselves their problem of existence. This is now so well recognised that almost every country in the world has its official entomologists. The literature of the subject increases with leaps and bounds, so that it is no longer an easy task to give a general account.

The book is illustrated. While some of the figures are good, others have been drawn from poor specimens; a number could be improved, *e.g.* the figure of the Sheep Ked is poor, the egg of the Horse Bot Fly is represented upside down, and the drawing of *Psoroptes equi* is wrong. R. Stewart MacDougall.

OBITUARY.

Councillor James Alston.

Councillor James Alston, Glasgow, died at his residence, Glenbank, Carmunnock, on 22nd November, at the age of fifty-nine years. Mr Alston became a member of the Glasgow Town Council in 1904, and took an active part in its afforestation operations. Latterly, as Convener of the Ardgoil Estates Committee of the Council, he strongly advocated the important afforestation scheme drawn up by Mr James Whitton, Superintendent of Parks, and assisted in the carrying out of this scheme.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXX.—PART II.

July 1916.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

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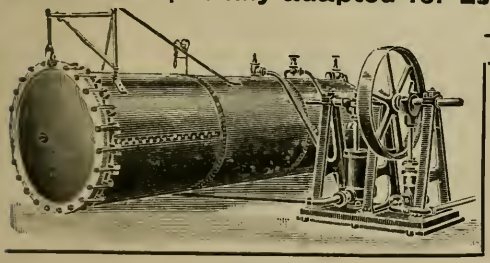

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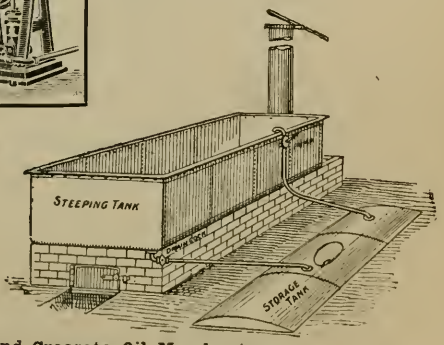

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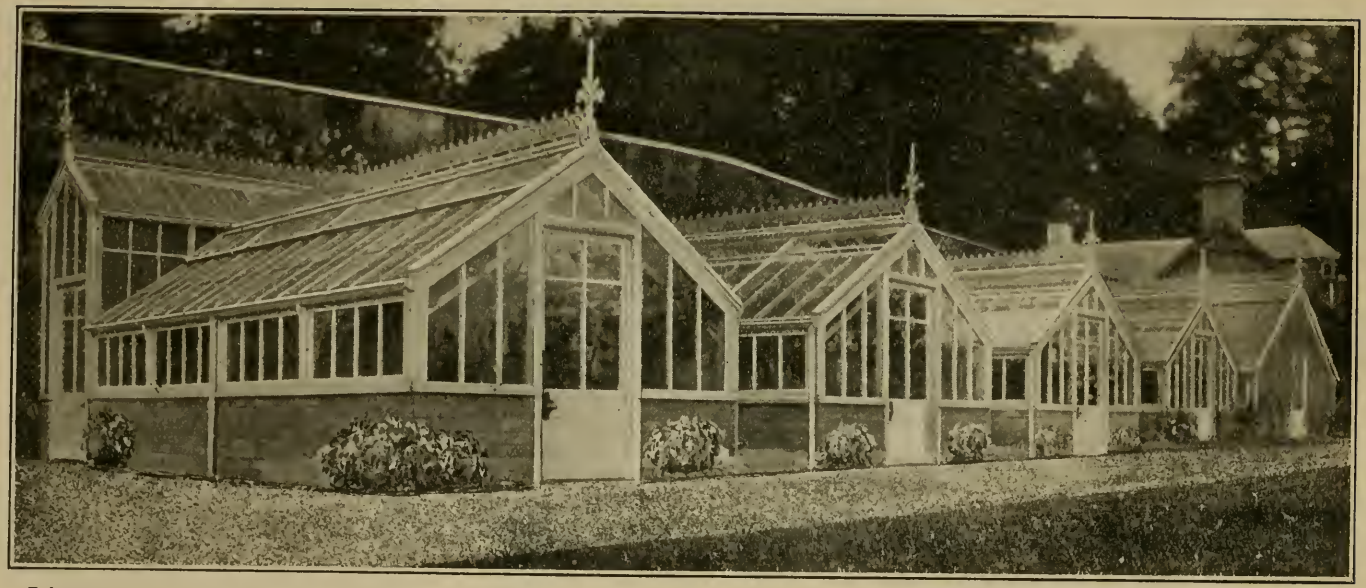

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Royal Scottish Arboricultural Society

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Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

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9. The Society's Annual Meeting: President's Address and Discussion.

At the Annual Meeting of the Society, held on 5th February, the Chairman, Sir Andrew Agnew, Bart., said:—"I beg to thank you all very cordially for the high honour you have done me in electing me President of the Society. I look upon it as a very high distinction, and I will do all I can to justify your choice. I own I accept office with a good deal of misgiving when I think of the far more capable men who have held the position before me. I think the Society has been always fortunate in its presidents hitherto. To mention only two or three of my predecessors—Colonel Stirling, Sir John Stirling-Maxwell and Sir Kenneth Mackenzie—I feel that these are difficult men to follow, but I hope, and indeed I think I may say, I feel sure that they will be willing to give me the benefit of their experience in any case of difficulty that may arise; and I know that there is always Mr Galloway, who knows the ropes better than any one, to whom I can always turn for friendly and safe counsel. I hope that during the year of office while I occupy this position we shall see some definite advance in the cause in which we are all interested.

"Forestry is not one of the questions that have been shelved by the war; on the contrary, the war has brought it into greater prominence than before. It has given the country an opportunity of realising to what an undue extent we have been depending upon foreign supplies, and how very inadequate are our own native timber supplies. As soon as the war began a scarcity of timber began to be felt, and there was some anxiety lest some of our leading industries might be crippled for want of timber. The Government felt obliged to intervene to provide a sufficient amount of pit-wood to keep our collieries

going, and since then they have been making very extensive purchases themselves to meet their own war requirements. The result is that the demand for home supplies has been greatly in excess of the normal supply, and that we can only meet it by drawing upon our capital and sacrificing, for the purposes of the present moment, woods which might have been expected to supply a regular amount of timber for many years to come. Exactly the same thing happened in the Napoleonic Wars a hundred years ago. When Napoleon established the Continental system, as it was called—the system by which he hoped to cut us off entirely from commerce with the Continent of Europe—there was a great demand for home supplies. It was at that time that many of the old Scottish pine forests were cut down bodily, but as they were indigenous woods, some of them have fortunately been able to spring up again by natural regeneration, but I am afraid that that is not likely to occur in the case of the woods that are being cut down to-day. It is hoped that these circumstances may incline the Government to pay far more attention to forestry than it has done hitherto, and you will agree with me, I think, that it must be our business to see that the subject is not neglected. It has not been altogether neglected of late years, though the progress has been far slower than the sanguine among us might have hoped, but every year there has been a certain amount of progress to record.

"Some provision has now been made for forestry education and research. The salaries of lecturers are being paid, advisory officers have been appointed to whom we can look for advice in all questions of forest management, and though we have not yet got a demonstration area in Scotland, we are assured that the money is ready and waiting to be applied as soon as the ideal estate can be discovered.

"All these, of course, are very essential preliminaries, but now that the preliminaries are so well advanced, we ought to be within sight of the main business, to which they all lead, the business of national afforestation. I hope it will not be long before we may be called upon to discuss, not as a mere matter of theory but for a definite and practical purpose, the best methods by which national afforestation can be carried out in this country. But, in the meantime, there is a question which requires more immediate attention. It has been referred to by Mr Galloway in the report which he has read to us. I mean

the question of re-planting the areas which are now being stripped. I have referred to the large demand that there has been for timber for industrial purposes, and now that the Government has come into the market, and is dealing directly with landowners, the area which is likely to be cleared is certain to be very much larger. There is reason to fear that some of these areas, or many of them, might not be re-planted, and the question arises whether something ought not to be done to avoid such a misfortune. It is a question in which this Society cannot help taking a very keen interest. When we urge the creation of new areas of forest we cannot remain indifferent to the destruction of old ones. I have noticed amongst the members of our Society lately a growing feeling in favour of compelling landlords to re-plant areas which are being cleared. Well, I think there is a good deal to be said for it. Re-planting is certainly a moral duty, and compulsion is a word which does not frighten us to-day in the way that it used to do. And if compulsion is to be adopted, there could hardly be a more suitable time than this, when so much timber is being cut down, and when such good prices are being obtained for it.

"At the same time, it seems to me that if the Government begins to compel individuals to fulfil a duty of this kind, it ought to have a good record of its own. Or at least, it ought to make it clear that the record is going to be a good one in the future. My own personal feeling is this, I should not object to compulsion on principle, I should only object to it if it were to be used as a means of fastening upon landowners alone a task which the Government ought to share with them. I should like to feel sure that the Government would not consider the compulsion of landowners as absolving them from the necessity of doing anything more themselves. There are countries on the Continent, we are told, where this compulsion already exists, but then in those countries forestry has always been a national business. The State is the chief owner of forests. It runs them for the benefit of the nation, and when it compels private owners to maintain their woodlands undiminished, it is only compelling them to do what it has always done itself. But that is not the case here. In this country the Government has shown very little interest indeed in forestry, and only quite recently, after thirty years or more of preaching by this Society and kindred societies, it has at

length began to wake up; but even now, or at least until the beginning of the war, though millions could be found for social experiments, it has only been possible to obtain a very few thousands for forestry. Now a Government with a record of that kind has still to prove that it is a genuine convert to forestry. I do not think it could prove it better than by itself starting on the work of planting. When it has once engaged in the work of planting, I think it would be in a better position to insist on other people doing the same. What I think we would all like would be if the Government would say frankly, 'We have neglected forestry in the past; we intend to make up for lost time. We realise that the supply of timber in the country must not only be maintained, but must be materially increased. We propose to see to the increase ourselves by afforesting new areas, and we shall look to the co-operation of the landowners to keep the old areas undiminished.' I think that if the Government were to come forward with a policy of that kind, there would not be a single member of this Society who would not be glad to support them in any measure which they thought necessary for carrying it out.

"I will close by moving the adoption of the reports which you have heard read. They contain a great deal of interesting matter, and matter which will require careful consideration in the near future. I have already referred to one of the subjects mentioned—the question of re-planting. With regard to one other matter, and that is the resolution which was sent to the Secretary for Scotland with regard to the settlement on the land of returning soldiers and of finding employment for them in afforestation—I would say with regard to the reply which we have received from the Secretary for Scotland, that we should have been glad if that reply had been a little more definite and favourable.

"We quite recognise that the Board has a very great deal of important work to do at the present time, and that a question like this requires a very great deal of careful consideration, but at the same time we must remember that there is no question at the present time which could be more pressing than this one of making ready for the return of the soldiers after the war, and making some provision for those who desire to lead a more open-air life than they have done in the past. I am glad to say that we have Mr Sutherland here with us to-day, and I hope we shall hear

something from him presently, but though he may not be able to say anything very definite with regard to this particular point, I hope he will be able to reassure us that the question is not being lost sight of, and is not likely to be lost sight of."

Mr Sutherland.—"Sir Andrew Agnew and gentlemen, I feel I am probably not quite in a position to deal fully with the Secretary for Scotland's letter, but I would like to say this, that at the present time I think we should not press too much the question of afforestation. We are all very keen about it. I know you are, and I know everybody is anxious to forward afforestation, but this is hardly the time to talk very much about it. The country is involved in a serious war, and it is now our duty to see that the war is first of all concluded before we can deal with domestic questions of this kind. Afforestation really means a greal deal of very heavy expenditure, and money is not easily found at present, and just for the moment I would rather turn your thoughts to the urgent necessity of utilising to the best advantage the timber that is growing at home.

"The Government have appointed a Committee for the purpose of purchasing the standing timber, and of manufacturing it. That Committee has not been appointed to enter into conflict with the trade, and it is not the intention of the Committee to compete with the trade. Its duty, in the first place, is to increase the production so that our forces in the field may be supported by material, and, in the second place, to conserve, as far as possible, our own capital, and to make use of our own money in this country. On behalf of the Committee I would ask you all, as far as possible, to co-operate with them, to help them, not only in the production of material, but in other ways, such as by offering the services of any men you know who could help the Committee in fulfilling and carrying out its work. I should say from the date of the commencement of our work we have found the Timber Trade Association, and the members of the timber trade in Scotland, most desirous and willing to assist. We have got from them, and through them, a very much larger supply, for instance, of the most necessary requirements than we have as yet obtained in England. The timber merchants of Scotland have done exceedingly well, and it is our hope that the present satisfactory relations that exist between the trade and ourselves will continue to the end.

"We have appointed a small Committee to assist us in Scotland

in the work, and that Committee is represented by your own Society, by the Landowners' Co-operative Forestry Society, the Factors' Society, and by the trade, and I hope the combination of wisdom we have got there will materially assist in this work. The Secretary for Scotland's reply is, I think, a very reasonable one under the circumstances, because, while the country is considering, and the Government are seriously considering, what must be done with the men who return from the war, the possibilities of small holdings and afforestation really require very grave attention. You must remember that everything connected with buildings, everything connected with capital outlays upon such subjects as holdings or farms, is at least 50, and in some cases 75 per cent. higher than normal; and besides that, even if the money were forthcoming, and it was possible to do it, the men are not here to build the houses and to plant the land, and without the men you cannot make much progress with any scheme of that kind. I think, from the point of view of the Society, you should for the present direct your thoughts to the various methods by which, later on, when the time comes, you can make afforestation secure. In that connection I find, for instance, that while home timber is being offered for sale very largely, while it is sold at a good price, and while the merchant is hurrying it into the mills and into the pits, that he is not paying attention to the one thing of importance, and that is, the proper grading of the timber. Timber in the home trade is looked upon, I am afraid, too much as a mere passing subject, and the sooner it is into the mill and out of it, the better everybody is pleased; but that is not the way to work.

"A forester of very considerable experience, whom I consulted the other day on this matter, said he had been attempting to grade home timber as it came forward, in the same manner as timber which comes from abroad is graded. The result was that only from 2 to 5 per cent. of a good lot was up to first Archangel, only from 5 to 20 was up to second Archangel, 20 to 70 was equal to third Archangel, and the rest was useless. Now there is a tremendous wastage here. When we are manufacturing and endeavouring to put our timber to the best use, we really should try to make as good a reputation for it as possible, and not to hurry it through the mill into the market without trying, at all events, to give it the same chance as the stuff that comes from abroad.

"In connection with the scarcity of pit-wood, it occurs to me to

say that lately I have been considering the position of the country, both from the point of view of the past and of the future. If only thirty years ago it had been decided that 100,000 acres a year should be planted, and if that had been steadily done at an annual cost of half a million, the result would be to-day, at the end of thirty years, that we would not require one stick of pit-wood for our mines from abroad. The position would be that the whole of the capital outlay of thirty years would probably be repaid within the next three years, and still we would have our established crops growing over a million acres. The tremendous advantage of that I need not go into, but I am pretty clear that this is no overstatement.

"The chairman has referred to the demonstration area. The Board have been able to arrange with Col. Steuart Fothringham of Murthly, and with Col. Stirling of Keir, for the complete use of their woodlands for demonstration purposes. These two gentlemen have come forward very generously at a time when we were in an unfortunate position for forestry demonstration, and we have concluded most satisfactory arrangements with them. These arrangements are only temporary, and I think everybody agrees that no demonstration area will be any good unless it is absolutely permanent.

"There is another subject which I wish to refer to, because I believe it is causing a certain amount of anxiety to landowners who are selling their timber, and that is the question as to whether there will be an extra charge on them for excess income under the recent Finance Act. Some people have rather hesitated about selling more than their ordinary output because they thought that they might have to pay not only ordinary income tax, but also excess tax. This matter has been considered fully by the Board of Agriculture and Fisheries in England along with the Chancellor of the Exchequer, and we have heard that the Chancellor of the Exchequer has stated distinctly that so far as income from woodlands is concerned, landowners are to be assessed in the ordinary way under Schedule B. Thus there will be no additional tax."

Sir John Stirling-Maxwell.—"Perhaps I might be allowed to say one thing, as a member of the Committee referred to by Mr Sutherland. All interested in this subject are under a great obligation to Mr Sutherland for the work he has put

into the forestry side of his department. We all know that he shares our aims and wishes. In his official capacity he is not in a position of perfect freedom, but the work he is doing will do a great deal to realise our aims. In regard to one matter, the question of afforestation, which Mr Sutherland rather deprecates our urging at the present, I would like to say this. It is quite true that you could not defend the use of afforestation as a mere means of settling soldiers on the land after the war. It would be a very cumbrous way of doing it, and a very expensive one, and we shall never urge afforestation from that point of view alone. We rather take the view that a country which has been surprised with wholly inadequate supplies of timber would be very foolish indeed, if it did not take immediate steps to put itself right in that respect. And therefore we feel that if, as some people suppose, the period after the war does afford a good opportunity of settling people on the land, this need of larger forests should be borne in mind when arrangements are being made. The most we would ask now would be that proper areas should be marked down, and preliminary arrangements made, so that at short notice this work can be undertaken after the conclusion of peace. As to building, no one now would think of such a thing. One would rather expect that forests would begin to be planted under conditions more or less temporary, and temporary huts or buildings used for a period of years. But we hope that there would be gradually developed a permanent resident population."

Mr H. M. Cadell of Grange said there would, no doubt, be plenty of wooden huts available after the war, and that such huts might be purchased at a very small cost, and until more permanent houses could be provided, these would serve the purpose of settlers on the land. As regards denuded woodland areas, the important thing is to get the best kinds of trees planted. Mr Cadell mentioned that black Italian poplar, planted twenty-seven years ago by him, had grown extremely well, some specimens having attained a girth of 36 inches. Black poplar is very easily grown, and it deserved to be more extensively planted in future. In ten years' time a large proportion of the pit-wood required by the mines could be grown in the country.

Mr Adam Spiers, Edinburgh, said the great trouble with the timber merchant at present is the inadequate supply of men, which meant that the mills are not being worked to the full

capacity of their output. It is important that all the mills should be fully manned. There is no scarcity of timber, but the shortage of labour made it extremely difficult to cut and handle that timber; also the expense of keeping mills running when only half manned added considerably to the cost of production. Mr Spiers went on to say that it seemed to him very necessary that the question of afforestation should be kept prominently and persistently before the people of this country, as they do not generally realise the enormous national assets that have been lost to the country for the last hundred years. We are one of the worst afforested countries in Europe, and yet there are few trees of economic importance and commercial value that we cannot grow. Mr Spiers further referred to Mr Cadell's remarks about the black Italian poplar. He knew of no tree which produces the same volume of wood in the same time. It is perfectly suitable for colliery purposes, and also for sleepers, for which large quantities of timber are required. We are neglecting the cultivation of hardwoods generally. There is nothing which Scotland lacks more than good, well-grown hardwoods of every kind. A great many of the hardwood trees which are put on the market are so heavily crowned and branchy that they do not command good prices owing to the more costly conversion involved in the case of such trees, but properly grown hardwood, of any kind, will always command a good price. Austrian and Russian oak at the moment cannot be got, and even before the war it was lessening in supply every year. Cabinet-makers and builders feel this want very much. In reference to the conifers he strongly advocated the extended cultivation of the common spruce as a tree of great commercial importance.

In conclusion, Mr Spiers said there is no country which can produce hardwoods like our own, but they are generally very much damaged by rabbits before they get started to grow. Rabbits will grow anywhere, and if you give every forester a gun, you will get a grand stock of trees, but it is impossible to grow rabbits and trees together.

The Chairman.—"I think we should be very glad to hear Sir William Haldane on this question of rabbits."

Sir William Haldane.—"I should like to say first that I think the proceedings this afternoon have been unusually interesting. They are always interesting—sometimes they are almost lively—but under your presidency they have been both interesting and

lively, and lively in the right sense if I may say so. I think your own address has been extremely interesting, and various subjects have been touched on by others in an interesting manner.

"I must say I have great sympathy with the views which Mr Spiers has just expressed, and on the subject of what our attitude at the present time should be as a Society, I think probably there is a middle course between the two views which have been suggested by Mr Sutherland on the one side and Sir John Stirling-Maxwell on the other. We certainly cannot expect at the present time to be getting large Government grants—that is out of the question just now. As Mr Sutherland said, we have to concentrate our attention on winning the war, and our finances have to be available for that first of all, but at the same time I think there is a great deal to be said for thinking out the problems that are ahead of us. We are all quite convinced of this, that after this war we are bound to be faced with some very stiff problems indeed, almost as stiff as those that are facing us to-day, and I think that we ought to be preparing for these, and among other things that we should be doing is to be thinking out schemes by which employment will be provided after the war. Now, I happen to have a little experience of the preparation of public schemes presented for Government consideration, and I know that in all such schemes, especially those affecting land, the time that it takes to get a scheme in working order after all interests have been considered is very great, and if we wait till the end of the war before these schemes are presented for consideration, a great deal of suffering will be felt before the schemes actually come into operation. Therefore I think that those of us, especially those of us who are above military age and who may possibly have some spare time, among other calls, to think out these problems—we should be devising something, and I do not think we should be too dependent on Government officials. They are very busy many of them just now, and after all I think there is a great deal to be said for trying to stand on our own feet in these matters. We make more progress if we try to do things ourselves than if we are always looking round for other men to do them. I think we have been guilty in the past as a Society in that way. This Society can think these things out well, because they involve the question of how to deal with certain classes of land, and the first person we have to consider is the landowner, with whom

this Society is very much in touch. We should be able to do a good deal in trying to think out a scheme sympathetically with the landowners of the country, which might have a very good chance of being carried out practically as soon as the war is at an end.

"There is one thing, as Mr Sutherland has hinted, and the other speakers have hinted at this afternoon, which we must bear in mind. The available funds of this country, as of other countries, after the war will be very limited indeed, and therefore we must think out any schemes that we wish to put forward, on a basis of the strictest economy. I do not think that it is impossible for afforestation schemes to be presented and carried out on that basis if the land is available for the purpose. Now, something has been said about the duty of the State to come in and do its part. We have had some experience of Government departments in afforestation. I do not want to say much about that. We all have our own ideas of the success or otherwise of the Government departments of this country in carrying out afforestation, and if you knew everything you would find it was pretty much the same in other countries. Somehow or other the Government official makes a splendid watch-dog, but he is not always the very best of work-horses.

"I suppose we have all seen a State show, the magnificent coaches and well-fed horses, their wonderful trappings, and particularly we have all noticed that the horses are kept well in hand with a bearing-rein. The bearing-rein is always on the Government official, and always will be, and therefore I do not think that we need look for too much in the way of practical afforestation work from him. Now that brings me back to this, let us try to stand on our own feet, let the landowners in Scotland and this Society assist as far as they possibly can in putting forward schemes which we wish to work out practically with Government assistance. I am often told I am very deficient in Socialism, and that may be so. I daresay I am old-fashioned about that, but I cannot help emphasising my view as to the duty and the power of the landowners of this country and the general public to work individually in this matter.

"There is one topic which Mr Spiers has touched on, on which I would like to make a suggestion for consideration in preparing any scheme to be carried out after the war. It has always seemed to me that rabbits are one of the most serious

obstacles to afforestation in Scotland. I have once or twice started small campaigns on my own account in newspapers on the subject, and with a certain amount of backing. I do not much like compulsion, although in your address you have prepared the way for our accepting it, but I am afraid there must be a little compulsion as regards rabbits. Large landowners in Scotland are able to protect themselves fairly well from rabbits, but we have to consider the smaller landowners who are at the mercy of their neighbours. If they are to do anything in planting, they must get some protection and some assistance, and I wish to suggest that if you think it should be remitted to the Council for consideration as to whether some general basis for the preparation of an afforestation scheme might be adopted, this question of rabbits might also be specially considered. It might be possible, without treading on people's toes too much, to propose that, say, the Board of Agriculture should be given power to proclaim a district as a rabbit-infested area, and there to employ rabbit catchers to keep down the rabbits. I hope that is not too radical a suggestion. It would mean power of course to go all over the district, that is to say, if the proprietors did not see their way themselves to kill down the rabbits and make it unnecessary to employ a public trapper."

Mr Robert Lumsden, Edinburgh.—"Mr Spiers has touched on a point which may be overlooked—the labour question. Would it not be quite within the sphere of the Society to make a representation to the proper authorities to point out that the output of home wood can be materially increased if it were possible either to arrange for men, who are practical workmen, coming back from the army, or to bring men over from Ireland from some of the places where they are not cutting wood."

Sir John Dewar.—"I do not understand this complaint, because wood cutting and labour in connection with home-grown wood is a reserved occupation. The men engaged in that are exempted—they are attested, but they are not called on for service. If woodmen are engaged on Government work, the Government are prepared to bring these men back to help the carrying on of at least Government work."

Mr Spiers.—"My men went away before."

Sir John Dewar.—"They may prefer the trenches to cutting wood."

Mr Spiers—"I think I could get some back."

Sir John Stirling-Maxwell.—"We have been at war eighteen months, and the men we need were gone before forestry was made a reserved occupation, that is the trouble. Mr Sutherland, who speaks from the official standpoint, perhaps cannot speak as freely as I can, but I am quite satisfied that the Government are now doing everything that they possibly can to ensure that there should be more labour at the disposal of those who are cutting wood, but their position is very difficult, and I hope as time goes on military labour will be organised for this purpose. This seems the only hopeful direction in which any progress will be made, and it looks as if the time would come very soon, as I ventured to point out many months ago in the *Scotsman*, when the Government would have to choose between having that wood or having certain soldiers capable of bringing the wood in."

Mr Charles Robertson, Forester, Colstoun, Haddington. —"There are many men employed by proprietors who are equally able and capable of doing timber merchants' work. If those men happen to be employed on an estate rather than by a timber merchant, they will not so readily get exemption."

Sir John Dewar.—"Yes, sir, they will."

Mr Lumsden.—"Might I suggest that some representation be made?"

The Chairman.—"I think that some representation of the kind has already been made by the Council to the Board of Agriculture, and we have received assurances that the matter is being very carefully attended to."

Mr A. D. Richardson.—"There is one aspect of the question that has not been touched on, and that is the production of wood-pulp. That is a very important industry in some of the Continental countries, and also in North America. I do not see why a great amount of wood-pulp used in this country should not be produced here. At present there is to be restriction, and we are going to have fewer papers to read shortly, because newspapers and literature of that sort are all produced on paper made from wood-pulp. Now Mr Cadell referred to the growing of black Italian poplar. Every one knows that it is a very rapid growing tree. A very large proportion of the wood-pulp in North America is produced from American 'cotton wood,' which is one of the parents of that tree. There are even faster growing trees then the black Italian

poplar, which can be grown equally well. The black willow is also good for pulp, and there are other poplars. There is a paper by Professor Henry, published in the *Transactions*, on that very subject. These are things which we should keep an eye upon, because if forestry is to make any progress at all it must be started at any rate with fast-growing timber like these poplars and fast-growing conifers. I do not see why, for example, plantations of poplars should not be formed with spruce as an under-plant. Spruce is one of the best trees for wood-pulp, in fact the bulk of wood-pulp is made from spruce. Then, of course, spruce is a very valuable timber, as we all know. It forms a large amount of the timber used in house-building, and other construction work. I think in connection with hardwood also we are neglecting very much the growth of some of them, for instance, ash. Most of the handle-wood used in this country is American ash and hickory. Every one knows hickory is not so good for handle-wood as ash, as men do not like hickory handles. Home-grown ash is far better wood. Elm is an extremely valuable wood, also plane and beech, as Mr Spiers has said. If we paid more attention to woods like ash and elm and two or three others—oak, too, of which great quantities are imported from Continental countries—we could produce an enormous quantity of timber. The great drawback is that all our own timber is so roughly grown."

10. Notes on the Corsican Pine at Lochnaw.

By Sir Andrew N. Agnew, Bart., President of the Society.

There is no tree which has come into general use in Wigtownshire during the last half century which has proved so serviceable as the Corsican pine (*P. Laricio*). At least that has been our experience on the Lochnaw estate, where it has been planted regularly for forty years. It is an extremely hardy tree, growing and thriving in the poorest soil and in the most exposed situations. The Corsican pine has the reputation of being difficult to establish, but we have never had any trouble with it. The losses among young plants have been no greater in this species than in any other. It is, indeed, rather slow in taking hold of the ground, and is consequently rather apt to get a shake in stormy weather during its first year or two. But once this stage has been got over, it is the most reliable tree we have; making the best of any circumstances, and standing erect and unshaken in the teeth of the fiercest gales.

I have known more than one case on this estate where a plantation has been saved by the introduction of the Corsican pine. The most striking instance is that of a low hill first planted in 1854 with the usual mixture of trees customary at that period. The soil was poor and the exposure a trying one, and nothing could be induced to grow upon it. Year after year the blanks were filled up, but with the most disappointing results. At last, by a happy inspiration, the Corsican pine was introduced, especially along the exposed edges. From that moment the plantation began to make a surprising recovery, and is now growing into a dense and flourishing wood.

The first Corsican pine planted at Lochnaw was in the year 1853. It is now a well-grown tree, 62 feet in height, with a gently tapering stem measuring 5 ft. 3 ins. at 5 feet above the ground. It was not till 1870 that the prices quoted for young plants in nurserymen's catalogues were sufficiently low to enable this tree to be used extensively for forest purposes. Since that date it has been constantly planted at Lochnaw, though always in conjunction with other species. There are only two cases in which an acre or so has been planted with Corsicans nearly pure, and in both cases the result has been very satisfactory. Some measurements recently made in one of these plantations may prove of interest. The plantation was made in 1887 and covers

a fairly steep bank which faces south-east. The trees are standing, on an average, rather over 5 feet apart, so that there would be about 1500 to the acre. At the foot of the bank, where there is a good depth of soil, they average 38 feet in height, with a girth varying from 24 to 30 inches. On the upper part of the bank growth has been somewhat slower, the average height being about 28 feet with a girth of 20 inches.

The two things that catch the eye at once in a grove of the *P. Laricio* are the upright figure of the trees and the cylindrical shape of the stems. These two characteristics seem to mark out the tree as being specially adapted for pit-wood. There has been a great demand for home-grown timber for pit purposes since the war began, and to a lesser degree the demand is likely to be a permanent one. This will lead to more timber being grown in this country with the express object of supplying the collieries. It used to be thought that the wood of the Corsican pine, at least while young enough to be used in the round, was inferior in strength to that of Scots pine, and the latter was consequently preferred for pit props. But this objection is no longer maintained. And since, next to strength, the two most important qualities for pit props are straightness and absence of taper; and since, moreover, the yield of timber per acre is rather higher in the case of Corsican than in the case of Scots; it seems quite likely that the Corsican pine may prove to be the most useful and profitable crop that can be grown in Scotland for colliery purposes.

To any one who is not a scientific botanist, it is a surprise to find that the Corsican and Austrian pines are so closely allied as they appear to be. According to the nomenclature of Kew, the Corsican pine is *P. Laricio*, and the Austrian is *P. Laricio* var. *Austriaca*. To the outward eye no two pines seem more dissimilar. The Corsican is an upright tree of narrow outline, with slender branches in regular whorls, and soft, flexible needles; while the Austrian is of an altogether coarser type, with big irregular branches, and needles stout and sharp. And if they are unlike in outward character, they seem to possess some inward difference equally marked; for while the omnivorous rabbit has a decided liking for the Austrian, he will rarely touch the bark of the Corsican. This immunity from rabbit attacks is a great point in favour of the Corsican; for, where it is planted pure, wire-netting may be dispensed with, and a considerable saving effected.

II. The History of Glenmore Forest.

(*With Plate.*)

By P. Leslie.

Glenmore Forest, the property of His Grace the Duke of Richmond and Gordon, is one of the most celebrated woods in Scotland; and as a large part of it has recently been sold the present time may not be regarded as inopportune for reviewing its history.

In the present paper the writer has collected some old records relating to the forest, and arranged them, with explanatory notes, in the order in which they were published. As some of the records are of considerable historic interest, and have not hitherto been reprinted in the *Transactions*, this method of treatment has obvious advantages, although some items of information may appear in more than one account.

Glenmore forms a glen surrounding Loch Mhorlich, the source of the Druie, a tributary of the Spey, which drains Rothiemurchus and Abernethy. This glen is sheltered on all sides, except the west, by lofty mountains—Cairngorm, the blue mountain, on the south, Meall à Bhuachaillie on the north, and a ridge, 2500 feet high, on the east. The situation as a whole is therefore exceedingly well sheltered, and trees attain large dimensions at considerable altitudes. The woods extend from Loch Mhorlich up the sides of the mountains in all directions, at elevations ranging from 1100 to 1400 feet.

Public interest was first aroused in Glenmore Forest about 1786, when two English merchants purchased the forest and started felling operations.

In Sir John Sinclair's *Statistical Account of Scotland* (1794), the ministers of the parishes of Abernethy and Speymouth allude to the busy scenes associated with the felling and floating of the timber, and the shipbuilding industry, at the mouth of the Spey, as follows:—

"Abernethy.

"*Glenmore Wood.*—About eight years ago the Duke of Gordon sold his fir woods of Glenmore in the barony of Kincardine for £10,000 sterling to an English Company. There were some inferior companies tried it formerly, but they were not successful.

It appears pretty certain now that this Company will succeed in bringing away all the wood within their contract before their lease is out, which was 26 years, and it ought to be with profit in the end as they do much good to the country. They are regular and just, and carry on their business in every department of it with much exertion and propriety. This was the oldest, the largest and the best quality of fir wood in Scotland, and the best accommodated for water carriage to the Spey—a distance of 3 or 6 miles. The quantities of spars, deals, logs, masts and ship timber which they send to Garmouth or Speymouth yearly is immense, and every stage of the process of manufacture brings money to the country. Generally once a year they send down Spey a loose float, as they call it, of about 12,000 pieces of timber of various kinds whence they send it to England, or sell it round the coast. For three years they have sent great numbers of small masts, or yards, to England, to the King's yards, and other places, and have built about 20 vessels of various burdens at Speymouth, all of Glenmore fir. Among others, there is one now on the stocks about 500 tons. Without doubt, their manufactures raise the price of labour and other articles, and make servants for the farmer more difficult to get. The fir woods of this country exceed all the natural fir woods in Scotland put together without comparison. Sir James Grant's woods of Abernethy, of many miles in circumference, next the Duke of Gordon's in Glenmore, then Mr Grant of Rothiemurcus, who is supposed to have more trees than either of them, then the Duke's again. After that the laird of MacIntoshes in Glenfishy in a line of about 20 miles in length on the south side of the Spey. And all having the advantage of abundance of water to bring them to the Spey. Besides Sir James Grant has another wood of an excellent quality on the other side of the country on the river Dulven."

"SPEYMOUTH.

"At Garmouth, or the mouth of the Spey, there is a wood trade, the most considerable it is supposed of any in Scotland for home wood. The wood is mostly fir with some little oak and birch. It comes from the extensive forests in Strathspey, belonging to the Duke of Gordon, Sir James Grant of Grant, The M'Intosh of M'Intosh, and Mr Grant of Rothiemurcus,

and is floated down the river Spey in deals, planks, logs and spars. The medium prices of the best timber are as follows :—

Spar wood, from 16-24 feet long, and from 5-8 inches square, at	7d. to 8d. the solid foot.
Logs in the round, from 10-20 feet long and 12-18 inches diameter, at . . .	1s. the solid foot.
3-inch plank 12 feet long and 10 inches broad, at . .	3s. the piece.
2-inch plank 12 feet long and 10 inches broad, at . .	2s. ,,
1¼-inch deals 12 feet long and 8 inches broad, at . .	1s. ,,
1¼-inch deals 10 feet long, at .	10d. ,,

"The wood is partly sold at Garmouth, to the people in the adjacent country, but the greater part is carried coastwise by shipping. There are several persons engaged in this trade at Garmouth, but for some years past the greater part of it has been carried on by an English Company. Two capital wood merchants—Mr Dodworth of York, and Mr Osborne of Hull—purchased about 8 years ago, from the Duke of Gordon, the extensive forest of Glenmore in Strathspey about 50 miles from the sea, and since that time they have carried on the trade with great spirit. They employ a great many hands at the forest of Glenmore, in felling the trees and manufacturing them into plank deals, masts, etc., and in preparing the floats. The plank deals and masts are sent down the Spey in rafts conducted by men at the rate of 30s. the raft. The logs and spars are for the most part floated down the river loose to the number perhaps of 20 thousand at a time, with men going along the side of the river with long poles to push them on as they stick on the banks. These men have 1s. 2d. a day besides whiskey, and there will sometimes be from 50 to 80 of them employed at once in the floating. At Garmouth, this company has built two saw-mills for manufacturing the timber after it comes down. The one is a wind-mill, and works from 36 to 40 saws. The other goes by water, and works 30 to 36 saws. The wood belonging to this company is sent, partly to Hull and to the King's yards at Deptford and Woolwich, in their own shipping; but the most considerable part is sent coastwise all along the North coast

from Aberdeen to the Isle of Skye, or sold at Garmouth to the people of the country around, or employed in shipbuilding. The greater part of this wood is of the very best quality, equal, it is said by competent judges, to any that is imported from the Baltic, and inferior to that only in point of size. The largest masts are 60 feet in length. This company has built, since the year 1786, besides a number of boats, 23 vessels from 500 to 25 tons burden, the greater number about 200 tons, and amounting in all to about 4000 tons, and all of their own fir wood of Glenmore, both the planks and timbers. Some of these vessels they have sold, others they employ in their own trade from Spey and in the Baltic trade, and one was bought for the trade of the Bay of Campeachy. These vessels, though wholly of fir, are thought by good judges to be equal to those of New England oak, from the excellent quality of the fir. There are generally 28 ship carpenters and block makers employed by the Company at Garmouth, about 16 or 18 sawers and 8 saw millers, besides several other workmen. They build vessels by contract. Besides the above vessels built by the English company, several sloops have been built at Speymouth during the same time by others, and several have been repaired, and from the satisfaction they give, it is expected the trade will increase.

"A plank cut from a tree in Glenmore forest stands in the entrance hall to Gordon Castle. The inscription on a brass plate attached to the plank concludes the history of the connection of the English Company with the Forest. It reads as follows:—

> "'In the year 1783, William Osborne, Esq., Merchant, of Hull, purchased of the Duke of Gordon the Forest of Glenmore, the whole of which he cut down in the space of 22 years, and built during that time where never vessel was built before, 47 sail of ships of upwards of 19,000 tons burthen. The largest of them of 1000 tons and three others, but little inferior in size, one now in the service of His Majesty and the Harbles East India Company. This undertaking was completed at the expense (for labour only) of about £70,000. To His Grace the Duke of Gordon, this plank is offered as a specimen of the growth of one of the trees in the above forest by His Grace's most obt. servt. W. Osborne, Hull, Sept. 26th, 1806.'"

The memorial plank is 5 ft. 5 ins. in width at the butt end and 4 ft. 4 ins. at the top, and is of a rich brown colour. Sir Herbert Maxwell states (1914) that "The top of the magnificent tree lies where it was cut off, more than 100 years ago on the hill above Glenmore Lodge about 1400 feet above the sea, and is still hard and sound, 3 feet in diameter where it was cut off . . . the snows and rains of a century have made little impression on the bones of this giant."

Sir Thomas Dick Lauder graphically gives us his impressions of the change in the appearance of the wild region of Glenmore effected by the felling of the primeval woods. He also notes the first appearance of the present forest:—

"The forests of Glenmore and Rothiemurcus, though belonging to different estates, were so united as to form in reality one continuous forest, and they are now equally denuded of all their finest timber. We remember this, a region of such wildness where its calm silent lakes were for ever reflecting from their dark bosoms the endless forests of pine which rose distance after distance over the broken sides of their minor hills and more lofty mountains, and where the scenes we wandered through were such as the florid imagination of a poet might fancy but could not describe. Alas! the numerous lakes and the hills and the mountains are yet there, but the forests shall no more bewilder the imagination of the stranger till time shall give the same aged forms to those younglings which are everywhere springing up in the room of their ancestors. The Glenmore forest is fast replenishing itself. Nothing could be more savagely picturesque than that solitary scene when we visited it some years ago. At that time many gigantic skeletons of trees about 20 feet in circumference, but which had been so far decayed at the time the forest was felled as to be unfit for timber, had been left standing, most of them in prominent situations, their bark in a large measure gone, many of them without leaves, and catching a pale unearthly looking light upon their grey trunks and bare arms which were stretched forth towards the sky, as if in the act of conjuring up the storm which was gathering in the bosom of the mountains, and which was about to burst forth at their call."

The next reference we have to the young forest is that appearing in the *New Statistical Account of Scotland* (1845), where it is stated that the progress of the new growth in Glenmore

is so great that the result must one day be very profitable. Later on (1868) Grigor writes of it as follows:—

"Along the outside of this forest (Glenmore) young wood to the extent of several square miles has sprung up since the removal of the old forest.

"These trees grow slowly until they reach the age of twelve, which perhaps is owing to their roots not penetrating into the rich sub-soil. They are of all sizes under fifty feet, some crowded and others quite thin. This young forest is of the usual age for bearing seed, but very few cones are to be seen; and on examining the ground around the trees few of those of former years are found, and those are smaller and rounder than the cones of the low, country-planted trees, as is invariably the case in native forests."

Referring to the general appearance of the forest at the same time, Grigor says:—

"When I last inspected this forest there were still a great many fine trees, particularly on the borders of the lake, but none notable for great dimensions except a few measuring from 9 to 10 feet in circumference, of little value, knotty, bushy, and blemished. They stood at great distances, from 50 to 100 yards apart, and evidently had not been considered of consequence when the intermediate ones had been felled. In other parts they were in patches on the border of the lake and on hill sides: in both situations they grow rugged in figure and of great girth."

Except that the trees that were at the time middle-aged have now reached maturity, this description could quite well be applied to Glenmore forest at the present day. Here and there at considerable distances there are large scraggy and isolated trees, but all over the forest there are patches of the "young" forest, often several acres in extent, where the trees are growing closely together. Here they have produced long straight clean stems, about 50 to 70 feet in height. As a general rule, where the Scots pine is grown with any degree of closeness in its Highland home, it produces much cleaner timber than it does in the lowlands.[1]

[1] In a paper recently published by Dr Müller, Denmark, it is pointed out that the Scots pine in our Highland districts closely resembles the small crowned type of tree predominating in Finland and certain parts of Sweden. Local carpenters state that the timber of Glenmore is very tough.

GLENMORE FOREST.

The "young" growth that sprang up after the primeval forest was felled. On the lower slopes of Cairngorm, 1250 feet above sea-level. Note long clean stems 60 to 70 feet high. Photographed 1915.

[*To face p.* 90.

The part of the forest recently sold occupies the lower slopes of Cairngorm. It was purchased by Messrs Lockhart, timber merchants, for £10,000[1]—the same price as was paid for the whole forest in 1786; but it is not likely that any of the present timber will find its way to the King's dockyards. It seems a pity, considering the traditions of the forest, that it should be put to such common uses as railway sleepers and boarding for boxes. The timber will be largely manufactured in the forest. To facilitate its removal, a light railway will probably be laid down from the forest to near Aviemore Station, which is about 7 or 8 miles distant from the woods.

12. Discussion on the Utilisation of our present Home Timber Supplies, Restocking of Felled Areas, and the Establishment of State Forests.

An important discussion took place on the above three subjects at a special meeting of Council, held on the 8th of March last. Mr G. Leven introduced the first subject, Mr Richardson the second, and Mr Price the third.

Utilisation of our present Home Timber Supplies.

Mr Leven opened his remarks by saying we are reminded every day that we are at war, and that the prosecution of it in such a way as to bring about a termination of it favourable to Britain and her Allies is of paramount importance. Our whole resources must be freely made available, and, we hope, available in the sense of being used to advantage.

The utilisation of our home, in preference to foreign, timber in many ways, at home, has long been advocated by this Society. The partial cutting off of our supplies of timber from overseas has always been considered more or less possible. It is therefore up to us, as a Society, to see to the conservation as well as the utilisation of our home timber, and endeavour to check wanton exploitation.

The Royal Scottish Arboricultural Society has been at work, for part, at least, of its sixty odd years of existence, trying to

[1] The forest was sold in 1914, but it has not yet been found possible to start felling operations owing to the scarcity of labour.

impress upon the nation, including Government departments, the need for giving greater attention to the production of timber at home. The gradual transition from "Arboricultural" to "Silvicultural" conceptions has been due, to a great extent, to the efforts of this Society, and, in short, what little progress has been made in matters relating to forestry, may fairly be claimed as due to its persistent energy. To any one giving the matter a moment's consideration, it should be quite apparent, that in the absence of a responsible Department, this Society should not discontinue its disinterested oversight of what it has done so much to create.

It is undoubted that, at the moment, home timber is urgently needed, and it is more than probable that it will be in demand for some years to come. If this is so, it is surely time that steps were taken to find out how much our home woods would systematically produce over a period of years. Taking Scotland as a unit, Mr Sutherland stated at the annual meeting in February last, that it had supplied far more timber of the kinds in urgent demand than the other portions of the kingdom. This, while quite indefinite, shows that a considerable amount of timber has been utilised already. Evidence is not awanting in, for instance, the central parts of the country, that large timber areas are being rapidly denuded of their crops. Where these crops have reached maturity this is probably quite a timeous operation, but in the absence of any Governmental guidance or control, there is more than a suspicion abroad that immature areas are being exploited. If this is the case, it is surely the duty of this Society to draw attention to what would be the outcome of such a policy, or rather want of it, in the near future, if continued. It is quite unnecessary, at this time and place, to draw attention to the desirability of having a regular annual output from a given area. Practical men know how difficult it is to attain to this ideal in the case of an estate where there are large gaps in the age-classes to tide over. It means the sacrificing of a certain amount of immature, or the retaining on the ground of over-mature crops, with the consequent serious loss of increment in both cases. How serious a matter it might be for the nation some years hence, if crops formed on right bases thirty, thirty-five to forty years ago, are being cleared off to any extent, we can little imagine.

Mature timber ought to be made use of first, for every purpose

for which it is suited, at home, but it would be good policy to utilise younger material from areas where the increment per acre is much below normal. This state of affairs may arise in many ways, as for instance, where the wrong species had been planted, where plantations have been damaged by snow at a certain age, where damage has been done by squirrels, rabbits, insects, fungoid diseases, etc., etc. So-called shelter-belts, and strips wrongly placed and treated, and not answering the purpose for which they were intended, might in many cases be cleared out (with a view to ultimate consolidation of areas). The first crop of trees, on what has been arable agricultural land, often fails at an early age, and where at all admissible and the crop of an exploitable age, it ought to be cleared off.

Thinning is more a cultural operation than a source of supply in an emergency, and need not be more than mentioned here.

All this, in short, implies control, to a certain extent, by the State, but we are getting used to that, and powers under the "Defence of the Realm Act" have probably been taken for more unimportant matters. The patriotism of one, or the keen business instinct of another, ought not to be allowed to run riot with our timber crops, and so undo what has only been attained after much effort. There is no reason why the State should allow indiscriminate clearing of "convenient" areas simply because they are convenient, at this stage of operations at least.

No time should be lost in setting about the getting up of data relating to the areas already cleared or now being cleared, before it is too late. The Board of Agriculture for Scotland ordered returns of all woodlands, on special forms, some time ago, and these ought surely to be of some use in forming the nucleus of what might prove valuable in after years, for, after all, we sometimes learn more from our failures than our successes.

Without recapitulation, if there is any point in what has been said, it is surely the duty of this Society to urge that immediate steps be taken to ascertain how far our home timber can be made use of at the moment, without endangering the future of the nation and of forestry, and signs are not awanting that their welfares will be more bound together in the future than they have been in the past. There is no apparent reason for losing our heads, or sacrificing in a moment what it has taken forty years of strenuous effort to attain.

Minute of Meeting.

The discussion which followed the paper was taken part in by all the members present. Mr Robertson raised the question of claims by County Councils for damage caused by extraordinary traffic in transporting timber, and suggested that the Government should deal direct with such claims. Several members referred to cases where County Councils had not waited until damage was done, but had endeavoured to get merchants to bind themselves to pay a fixed rate per ton in anticipation of damage. Mr Morgan stated a case in Perthshire where ½d. per ton was demanded for horse haulage, and 1d. per ton for mechanical haulage. Another case referred to was that of Garth, reported in the newspapers, where it was stated that the County Council had asked 6d. per ton, and the merchant had offered 2d. per ton, to meet anticipated damage.

The meeting took the view that woods, having borne their proper share of the upkeep of the roads during the long growing period without having been the cause of any appreciable damage, were not liable in damage where the timber was transported over the roads in the ordinary course of utilisation. It was decided that the Secretary should write to the Home-Grown Timber Committee pointing out that, as very large quantities of timber were being transported over roads at present for national purposes, the Government should deal with any claims that might be raised in connection therewith, and that attention should be drawn to the case of Garth above referred to.

On the subject of labour several members suggested that efforts should be made to get the necessary men brought back from the army so that the existing mills could be fully manned, when the output would be enormously increased. It was mentioned that the Home-Grown Timber Committee was endeavouring to do this.

Mr Morgan suggested that copse, of which there is a large quantity in the country, might with advantage be utilised for pit-wood.

Mr Buchanan supported Mr Leven's contention that the fullest possible use should be made of the existing trade organisations and plant, and moved that Mr Leven's two points should be remitted to the Council's Home Timber Committee, with instructions to draw up a detailed scheme as to how they could best be given effect to, and to report.

Restocking of Felled Areas.

Mr Richardson, who was to speak on this subject, was unfortunately prevented from attending, but the Secretary read the notes which he had been kind enough to send in.

On the subject of replanting generally, he pointed out that an excellent opportunity would be given of rectifying mistakes which may have been made in the previous planting of these areas. He thought that the Government should make loans to proprietors to enable them to carry out the work, even although the rate of interest would be high to begin with. He suggested that the size of plantations should be increased, and the form improved, for the sake of economy in management, and that pure crops, or at least pure groups, should be preferred to the usual mixtures. He thought more attention should be given to spruce which, with Scots pine and such hardwoods as elm, ash, Scots plane, and perhaps some of the fast-growing poplars and willows, in suitable localities should form the leading species in ordinary planting operations. Larch should also find a place, but Douglas fir, Sitka spruce and Japanese larch should be used to a less extent. The plant should be adapted to the soil and not the soil to the plant. Shelter-belts ought to be widened, or otherwise enlarged, and worked for pit-wood so as to ensure that their usefulness as shelter-belts would not be impaired. Care should also be taken to see that the belts were running in the proper direction to provide the shelter desired. In conclusion, he suggested that there should be a scheme of co-operation between planters and nurserymen, so that the former might inform the latter some time ahead as to their probable requirements. If this were done, nurserymen would be in a position to sell their plants at a substantial reduction on the present prices.

The Establishment of State Forests.

Mr Price said it was almost unnecessary for him to say anything to an audience of the Royal Scottish Arboricultural Society on the desirability of—he had almost said on the pressing necessity for—State forests. Nor should he weary them by quoting statistics to show how great was that need—nor yet should he attempt to describe the forests held by foreign states—for most of the members of the Society now before him had themselves visited one or more of these. We had passed these

initial stages long ago. Their *Transactions* already abounded with more lucid suggestions and more graphic descriptions than any he could give,[1] and all were practically now convinced that State forests should and must come for Great Britain also. The question before them was, Can anything be done at the present moment? Is the present a suitable time to press home our convictions upon the Government, or should we wait until the war is over? No doubt the Government's hands are full at present, and one of its chief concerns is where and how to get a supply of timber for its urgent needs, and had we no other excuse than that of being consistently insistent in season and out of season, until our object is attained, we might be persuaded to leave the matter alone just for a little during such a crisis. But the question what is to be done with many of our ex-soldiers and sailors—fit and disabled—cannot be so shelved, and it seemed to him that by pointing out to the Government how well the two objects might dovetail in with each other, congenial and profitable occupation might, on the one hand, be found for many of our returning soldiers and sailors, and at the same time a start be made, under favourable circumstances as to labour supply, with the long delayed scheme of State forestry. He was himself firmly convinced that for the object he had just mentioned—that of providing suitable occupation for ex-soldiers and sailors—afforestation offered much better prospects of success than did small holdings, with which, unfortunately, the Government advisers seemed to be obsessed. If we stayed our hand until the war was over, he feared it would then be said, both of forestry and of national service, by those formerly opposed to these schemes: "Yes! We grant you they should have been adopted long ago, and then we should not have found ourselves in such straits, but the opportunity was lost—and the crisis is now past never to return—the need has gone by, let us turn our attention once more to other things." But that is not so. We can see, were our enemies ever more numerous or stronger than they now are, how our shipping might be seriously interfered with, and timber supplies, even from our own colonies,

[1] Very informative articles appear in Volumes xv. part 3 (1898): xvii. part 2 (1904): xxi. parts 1 and 2 (1908): xxii. parts 1 and 2 (1909): xxiii. part 2 (1910): xxiv. part 2 (1911): xxvi. part 2 (1912): xxvii. part 2 (1913): and more especially in the special Volume xxv. dealing with afforestation in Scotland (by Lord Lovat and Colonel Stirling of Keir).

cut off for some time. Even without such extreme reasons, it is easy to see how freight and other expenses might at all times be saved, and shipping set free for other things by producing more timber at home. Afforestation would improve our climate, and it would afford profitable work for a great many people.

Probably some of those present could remember that Ireland was threatened with another potato famine in 1883, and there was great distress in consequence. At that time Dr Lyons, M.P., set himself to find employment for a great number of people as a remedy for that distress, and his conclusion was this, that after the maturest consideration which he was capable of giving to the subject, re-afforesting seemed to him that operation which naturally admitted of the most immediate and most extensive application in the circumstances. And one or two large English municipalities when faced with the problem of providing work for a large number of unemployed, have found profitable occupation for them by planting up their "catchment areas." Might we not adopt similar methods with regard to the finding of a suitable occupation for many of our soldiers and sailors after the war, now being so hotly waged, is over?

There might be two or three areas chosen, and he thought not at all a bad one would be the valley of the Gala between Fountainhall Junction and Galashiels. The land there was not of high initial value—most of it is too steep for cultivation—it has various aspects—and there are a railway, a road, and a stream running alongside through the valley. The Lauder Light Railway skirts the north-east border of the area. Indeed by connecting Lauder and Earlston, a distance of some six miles or thereabouts, a complete loop-line would be formed, and these railways lead to Leith and Berwick seaports. There is ample room for storage at various points throughout the valley, and some at least of the timber might be converted into finished products at Galashiels or elsewhere. He only mentioned this area because he knew it well from frequently passing through it, but no doubt others as good or better might be found.

Mr Price went on to say that with regard to what Mr Leven had said as to replanting cleared areas, regarding which there seemed to be a difference of opinion as to whether this duty should be made compulsory or not, it might be well to look to the experience of Ireland as regards that also. Ireland, as we

all knew, always received more parliamentary consideration than Scotland did. Ireland was once famous for its forests, the area of which exceeded that of the open ground, and these forests appear to have been placed more than once under State protection. They were chiefly famous for their oaks, enormous numbers of which were cut to supply the needs of the navy, but a still greater quantity was cut for barrel staves. Ironworks too, consumed much oak. Numerous Acts of Parliament were passed to prevent the too severe exploitation of these forests, and to provide for replanting, but we read, "they were based on the principle of voluntary action, and being solely permissive in character—they failed in effect." History, as they all knew, had the habit of repeating itself.

The President, who had to leave the meeting at this stage, said we ought not to allow the question of national afforestation to drop into the background, and that we should continue to press the Government to declare their policy on the subject. Government must show that they mean business in this matter, and that they are in earnest about the subject. Meantime they had only been nibbling at it. They had never committed themselves to any definite and comprehensive policy. The Society wanted an acknowledgment that afforestation is a national concern, and having got that, they would be quite willing to wait, but until such an assurance is got the Society cannot drop its agitation. The question is one which does not command votes; and such questions are sure to be shelved unless constantly kept to the front. The Society must therefore continue wearying the Government until they feel obliged to declare a definite policy. He concluded by expressing regret for having to leave the meeting before the discussion was concluded.

Sir John Stirling-Maxwell, who then took the chair, said that he was sure the meeting would fall in with the suggestion of the President, that the Council should press the Government to give an assurance that schemes of afforestation would be prepared as suggested. This was unanimously agreed to.

A lengthy discussion then took place, in which most of the members took part. The finding of the meeting was that the President's suggestions should be given effect to.

Supplementary Note by Mr Price.—In the various articles in the *Transactions* to which attention has just be called, several

lines of procedure are suggested. Many favour the purchase rather than the leasing of land. Probably on its strict merits purchase is the better course. But we must take things as we find them, and we often have, like a stream, to follow the line of least resistance if we wish to make any progress. Money will be much more difficult to obtain for such objects after the war is over, and we must be thankful for what we can get, and make it go as far as possible. Keeping that in view, he was inclined to favour the leasing of land, rather than its purchase. Purchase requires a greater initial sum. It too would probably have to include other subjects not really necessary for the scheme of afforestation, but which would swallow up much capital, and increase the costs of administration.

Proprietors might, he thought, be asked to offer their cleared woodlands, or areas suitable for planting, to the Government on long lease, receiving from the Government the annual grazing value of same with perhaps a bonus or percentage on the ultimate profit as a further incentive. On this rent the proprietors would continue to pay rates. The Government would provide labour and plants, and control the management—no further taxation to be charged against the woods than Income Tax when profit accrues. Proprietors might be given an opportunity within a certain number of years to resume possession on repaying all back charges. This would free the Government money for further planting. Otherwise the Government would carry the thing through and realise the fellings, and replant. It should, of course, be optional to the Government to accept or decline any area offered—accepting, to begin with, only areas in suitable localities, and of sufficient size, not necessarily all on one estate, or even in close contiguity—but sufficiently large and compact to be conveniently and economically worked and controlled. Areas where the further manufacture of the forest products could be introduced and profitably carried on without large initial outlay should be preferred.

The number of such forest areas that could be carried on simultaneously would, of course, be limited by the funds and labour available. The supply of home-grown timber cannot for long years, if ever, overtake the demand.

13. Resolution on Timber Supply.

The following letter and resolution have been circulated to the various Departments and Members of Parliament, as indicated in the letter:—

"Sir,—I am instructed to send you the enclosed resolution on the subject of the Development of Afforestation in Scotland, which my Council hopes will receive your approval and support.

"I am also asked to enclose a reprint from *Country Life*,[1] of an article written by Sir Robert Lorimer, the eminent Scottish architect, on 'The Neglect of Home Timber,' which is of special interest in the circumstances.

"These papers have been sent to the Prime Minister, the Chancellor of the Exchequer, the Secretary for War, the First Lord of the Admiralty, the Secretary for Scotland, the President of Local Government Board, the President of Board of Trade, the Treasury, the Board of Agriculture for Scotland and the Development Commissioners, and to each Scottish Member of Parliament.

"I shall be obliged if you will kindly let me know that you will use your influence in pressing the resolution on the attention of Ministers and the Department concerned.—I am, Sir, your obedient Servant,

"R. Galloway,
"*Secretary.*"

April 15, 1916.

The Resolution is as follows:—

"The Council of the Royal Scottish Arboricultural Society, considering:

"1. That for many years the Society has been urging upon Government the necessity for adopting measures to promote afforestation in this country:

"2. That all our Home Experts in Forestry, and such of the Oversea Experts as have visited this country, including the eight distinguished Foresters who represented the leading Continental, Indian and Dominion Forest Services at the Society's Diamond Jubilee Celebrations in 1914, have unanimously expressed the opinion that Scotland lends itself admirably to afforestation on a large scale, and that Government ought to give the movement the support necessary to bring this about:

[1] Cf. pp. 103-8.

"3. That in recent years successive Secretaries for Scotland have promised on behalf of Government that a Department of Forestry would be created in connection with the Board of Agriculture for Scotland, but that such Department has not yet been formed :

"4. That the Board of Agriculture for Scotland and the Development Commissioners have failed to make reasonable provision out of the Funds under their control for the development of Forestry in Scotland, and that it is therefore necessary that the new Department of Forestry, when formed, should be provided with a separate annual grant adequate for this purpose :

"5. That the area of woodlands in Scotland previous to the War was about 868,000 acres, or only about 4 per cent. of the whole land area, being the lowest percentage of the countries of Europe (except Ireland and Portugal), and forming a striking contrast to other countries on the Continent having from 17 up to as high as 53 per cent. of woodlands :

"6. That the Annual Value of the Imports of Timber into the British Isles previous to the War was about £40,000,000 ; that between 80 and 90 per cent. of the timber so imported consisted of Coniferous or soft woods of which a large proportion could have been grown in this country, and if so grown would have provided healthy and remunerative occupation for a large rural population, and have prevented the present timber famine and the great shortage of tonnage from which the country is now suffering :

"7. That the War in which the country is at present engaged has directed particular attention to :—

"(1) The dependence of this country on Foreign Countries for timber of all kinds, but especially pit-wood and railway timber ;

"(2) The greatly increased demand for all kinds of home-grown timber — which owing to the widespread devastation on the Continent is likely to continue long after the conclusion of the war ;

"(3) The large areas of home woods that are being cleared to meet that demand, including young, thriving plantations, prematurely cut for pit-wood, for which they were not intended ;

"(4) The improbability that all or even a large proportion of these areas will be voluntarily re-planted, with the

result that the already relatively small extent of woods in this country will be alarmingly decreased;

"(5) The very large areas of comparatively poor land in the country which would be more economically used in growing timber crops than as at present used:

"8. That, during their various excursions abroad, the members of the Society were much impressed with what had been successfully done by the various Continental countries visited in combining schemes of Small Holdings with Afforestation to the great advantage of both:

"9. That Afforestation not only provides employment for a considerable population at the outset, but ultimately for a very large population in connection with subsidiary industries such as saw-milling, wood-working and other rural industries:

"10. That at the close of the War a large number of men will be returning home who may not be able to resume their former occupations, and would prefer to settle upon the land if they could be assured of a healthy outdoor life and a comfortable home, and that the return of such men will form a peculiarly suitable opportunity of making a beginning with the afforestation schemes which are so necessary to provide timber for our national requirements:

"RESOLVED.

"That it is necessary, in order to provide for the Nation's future requirements of coniferous timber and such hardwood timber as can be economically grown in this country, and also to afford suitable and healthy employment for a large and ever-increasing rural population, that Government should now create the promised Department of Forestry in connection with the Board of Agriculture for the Development of Forestry in Scotland, with an adequate annual grant for the purpose, and should instruct the Department to prepare, without delay, schemes of afforestation, combined with Small Holdings and other rural industries, to be put into operation as soon as the war is over, so that advantage may be taken of the unique opportunity when returning soldiers, sailors and others are desiring work, to induce a proportion of them to settle on the land by offering them immediate and suitable employment in comfortable and congenial surroundings."

14. The Neglect of Home Timber.[1]

(With Plates.)

By Sir Robert Lorimer.

In view of the attention which is at present being given to the question of how the supply of home timber may be increased, it may be of interest to examine the existing condition of the home-timber supply from the point of view of house builders and furniture makers.

In the year 1913 over £42,000,000 went out of this country in payment of imported foreign timber. The price for softwoods has nearly doubled since 1913, and the price for hardwoods has gone up about 25 per cent. As about 80 per cent. of the imported timber is coniferous and 20 per cent. hardwood, the cost of the same amount of timber as was imported in 1913 at the prices now ruling would be £76,000,000.

Building of every description in the devastated areas will have to be undertaken after the war on an unprecedented scale. Owing to the vast quantity of timber used for various war purposes, and the even greater quantity destroyed, there will certainly be a timber famine, and the Allies will be bidding against each other for any supply there is. The Germans will be able to get ahead much more rapidly not only owing to their own vast forests, which are, so far, uninjured, but also owing to the fact that they have had saw-mills going at the back of their lines cutting down French and Belgium timber and carrying it back into the heart of Germany. Surely, as was pointed out some months ago by an anonymous correspondent of the *Scotsman*, there is a fairly simple and obvious method of dealing with this situation; that German forests should in due time be used to supply sufficient timber for the reinstatement of buildings in the areas that have been ruined.

Any one who has been to Goslar in the Hartz Mountains—to mention only one of many forest areas—and has done any of the famous walks that radiate from this little mediæval town will remember the vast area of the State forests—over 130,000 acres in extent—arranged in great blocks, according to age-classes, the height of the trees in the different blocks varying from a few inches to over 100 feet.

[1] Reproduced by permission from *Country Life*. We are endebted to the Editor for the kind loan of the blocks of the accompanying figures.—Hon. Ed.

These forests give constant and healthy employment to a permanent staff of 1000 forest workers, and produce a crop of timber that yields an average annual net income of just over 14s. per acre. What fairer retribution could there be than that, when the time comes, Germany from her vast reserves should be called upon to supply timber to make good all that she has ruined? This solution, so far as regards the devastated areas, would be a great help, and would also serve to bring down the price of timber in this country after the war, and thus make building as a commercial proposition a slightly less difficult problem than it is, with everything at the present inflated prices.

The vast importance of timber as a national asset has never been realised in this country except by a little band of enthusiasts, who have received little encouragement from the Government in a matter where some form of State control and support is essential, to enable the work to be carried out on a large enough scale and in a sufficiently systematic manner to ensure ultimately an annual crop yielding a regular return. It is obvious that a laird who is just able to keep his old family place, and who foresees that his son will inevitably have to sell it, cannot be expected to embark on a planting scheme from which there can be no return to speak of for at least sixty years if he plants softwood, or for anything up to 300 years if he plants oak or other hardwood.

What is the present position in regard to forestry in Scotland and the supply of home timber? The Royal Scottish Arboricultural Society has been in existence for sixty years. During this period the Society and foresters generally have consistently and on every possible occasion urged the economic importance of a national system of afforestation, and the necessity for a continuous supply of useful kinds of home timber at a reasonable cost. As recently as last July the Society addressed a resolution to the Government urging that, as all the old and now familiar arguments had been greatly strengthened by events since the war began, steps should now be taken to prepare schemes of afforestation with a view of giving employment to returned soldiers and sailors and, at the same time, tackling this great national problem in a large way.

Sir Ronald Munro Ferguson, who has all his life been an enthusiastic student of forestry and a profound believer in its value to this country if done scientifically in large enough areas, states that his larch plantations on the Novar estate in Ross-shire

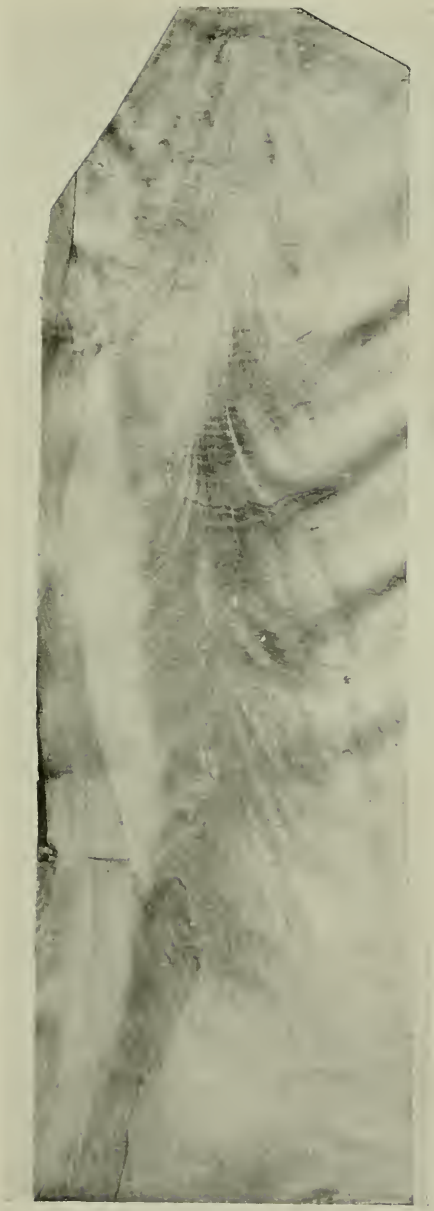


FIG. 1. PLANE TREE VENEER SHOWING "CURLS."

[*To face p.* 102.

FIG. 2. ACACIA: OYSTER VENEER.

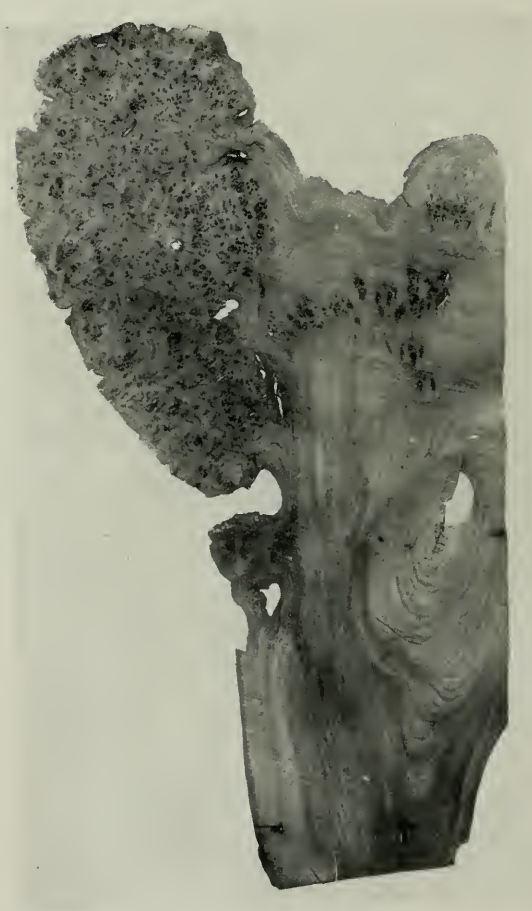


FIG. 3. GROWTH OF BURR IN SCOTS ELM.

yield a profit of 10s. an acre on land which if sold in the market as moorland would not fetch more than £1 per acre.

Thirty-seven years ago the Society instituted a series of annual excursions in the course of which they have visited the Hartz, Bavaria, Switzerland, France and Sweden, practically every country where trees are systematically cultivated. Interesting reports of these foreign visits have been published and an enormous amount of useful information tabulated. The Society's motto is a good one: "Ye may be aye sticking in a tree; it will be growing when ye're sleeping."

What, however, is the result of the Society's efforts to date? (1) That the landlords complain that they cannot get an adequate price for their timber when they want to sell it, and that they can often hardly get any one to take it for the lifting. (2) That when the architect who believes in local colour, the home product, the stuff with the tang of the soil about it, wants seasoned home timber he cannot get it. And (3) that the home timber merchants complain that it does not pay them to lay down and season a stock of home timber because there is a prejudice against it and no continuous demand for it.

That there has in the past existed a prejudice against the use of home timber for building purposes generally and also for cabinet work is undeniable, but is not this typical of the attitude of this country about many things? The foreign article is accepted without question as the best; so long as we get what we want and can afford to pay for it we don't trouble to ask where it comes from or into whose pocket the money goes; the result, as regards the timber trade, being that we have been pouring £40,000,000 a year into the pockets of the foreigner, when a considerable proportion of this money could have been retained in this country, and a large number of people might have been kept on the land usefully and happily occupied and rearing healthy children.

There are several millions of acres of waste land, much of which is suitable for planting. The only effort towards State afforestation that has yet been made, was the purchase in 1907 by the Commissioners of Woods of the Inverliever estate on Lochawe-side, of an area of over 12,000 acres, where experimental planting has been going on at the rate of, on an average, 160 acres per annum. The estate has unfortunately no direct access to the sea, and every practical man knows how essential

direct sea transport is, in this country at least, for any area of woodland that is to be worked at a profit. This is owing to the high railway rates and the want of encouragement in the way of providing waggons and other facilities at country loading banks, and also to the fact that preferential rates are given to foreign timber owing, presumably, to the fact that there is a constant traffic in it.

That a considerable trade in home wood exists is proved by the fact that one old-established firm at Larbert has four saw-mills at different places in Scotland, and eleven portable mills working in various parts of the country, and they employ on an average 400 men exclusively on the home wood trade. One member of the firm—who is an enthusiast regarding home timber—to show the faith that is in him, built himself a house some years ago and used home timber for every purpose, from the roof tree down to delicate pieces of furniture. What is wanted, however, is a constant and intelligent demand on behalf of the public which will make it worth while for the home timber merchant to lay down and season a stock of timber for domestic purposes, and also will encourage him, when he is cutting up wood for rough purposes, always to lay on one side selected stuff that is suitable for building work.

Let us consider what woods there are grown in Scotland which are waiting to be used for building purposes. Roughly they are as follows: larch and Scots pine can be used for joisting, roof timbers, etc., and from these woods also can be cut roof boarding and flooring boards, $3\frac{1}{2}$-inch widths being the most economical width to use owing to the fact that this also is the width of a paling rail, and in cutting up the timber the best can be laid on one side for flooring. Larch or Scots pine can also be used for ordinary window finishings, window boards, etc. Douglas fir, which is akin to larch and better than Scots pine, can be used for the same purposes. Selected spruce can be used for rafters and ties; home spruce can, in fact, be used for all purposes for which foreign white wood is now used. The indigenous Scots pine—which is practically the same as the famous Rannoch pine—if carefully selected makes beautiful panelling. Many old Scottish houses contain charming rooms, such as the well-known room at Rosslyn Castle, panelled in red pine, untouched by either paint or varnish, which time has turned into a beautiful cool colour.

Fig. 4. Scots Elm Burr, Quartered to make Panel.

[*To face p.* 106.

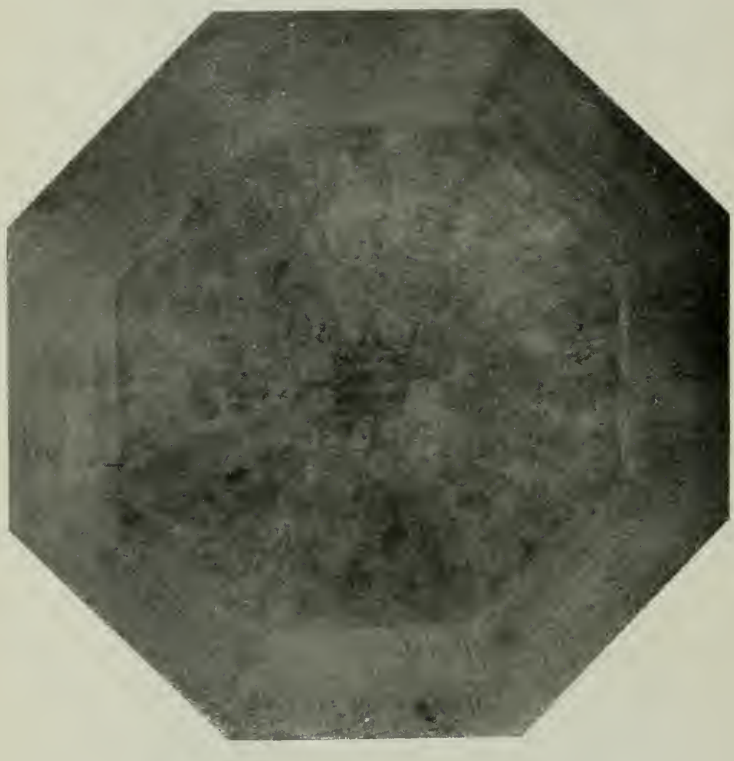


Fig. 5. Table-top of Scottish-grown Oak.

Elm also makes most attractive panelling if properly selected and used. It is also admirable in wide plain boards for linings of such rooms as a garden room, estate office or business room. I hear the reader object that it twists. So it does if improperly used and in an unseasoned condition, but if the wood be well seasoned and sympathetically handled the twisting can be got over.

Ash also makes good panelling, and so do both beech and plane tree, the latter being a most beautiful wood, hardly ever seen inside a house, but used for calendering and other commercial purposes. Veneers, whether those known in the trade as "curls," or those with waved or fiddle back markings, can also be got from this wood (Plate IX. fig. 1).

As king of the hardwoods—for the variety and beauty of its figure, for the multitude of the uses it can be put to, and for the glorious part it has played in "our rough island story" —oak is too well known to require any remark here, except that the Scottish-grown oak is in figure or "chamf," if possible, more interesting than English, owing to the fact that the growth has been slower and the fight with the elements more severe (Fig. 5).

As a result of the efficient organisation of the foreign trade, and also owing to the apathy of architects and of the public, it is lamentable to think of the enormous percentage of Austrian and other imported oak for panelling, flooring, etc., that was used in this country before the war. For character, for variety of figure, there is no sort of comparison between the two materials. Austrian is tamer, though slightly easier to work, but if the native trade were properly organised and marketed, the price for the home material ought to be slightly lower than the foreign, which would pay for the extra cost of working.

Scots walnut makes beautiful panelling for a room, but the supply is very limited. This is an example of a hardwood that might be much more grown as a feature in mixed plantations, and the timber always commands a high price. A room panelled in home walnut is a joy to live in.

When we come to furniture, the range of choice is considerable. (1) Oak, from which interesting burr veneers can be got. (2) Walnut. (3) Ash. (4) Elm; this tree also yields fine burr veneer (Figs. 3 and 4). (5) Birch, which is excellent for bedroom furniture. (6) Maple.

Among the rarer woods, which might be more grown and which would be much more used in cabinet work if they could be got with any certainty, are cedar, gean (wild cherry), mulberry, laburnum, holly, cherry and yew. Yew stands almost by itself. It is a most beautiful wood for cabinet work, and owing to its scarcity it is almost always used in the form of veneer. If left for some length of time in pond water, or better, if a log can be got that has been long submerged in a bog, it becomes a lovely purplish violet colour, cooler in colour than the famous West Indian King wood which the French are so fond of using in their fine veneered cabinet work.

Let us hope that one of the indirect results of this disastrous war may be to stimulate interest in the use of all our home products. If users of timber will demand home timber in any work, whether building or furniture, in which they may be interested, the battle will be already won and the public will soon follow.

Whenever home timber comes to what is called a "brisk inquiry," it will be worth while for the home timber merchant to employ his capital in stocking and seasoning it.

15. Meeting with Development Commissioners.

At a special meeting of the Council, held on 8th March, the President reported that he had received a letter from Sir William Haldane, suggesting that the Council might appoint representatives to confer with the Development Commissioners on the subject of afforestation of land in private ownership. He said that such an invitation could not be ignored, and he proposed that it should be accepted. The Council agreed, and appointed the President, Mr Price, and the Secretary, as the Council's representatives. The meeting took place on Friday, 7th April, and on reporting to the Council the committee were authorised to send the following letter to the Development Commissioners :—

"19 Castle Street,
"Edinburgh, 14*th April* 1916.

"Sir,—Our committee reported to the Council of the Society on Saturday, 8th inst., what took place at the informal discussion on Friday with representatives of the Development Com-

FIG. 6. SCOTS ASH BURR VENEER.

[*To face p.* 108.

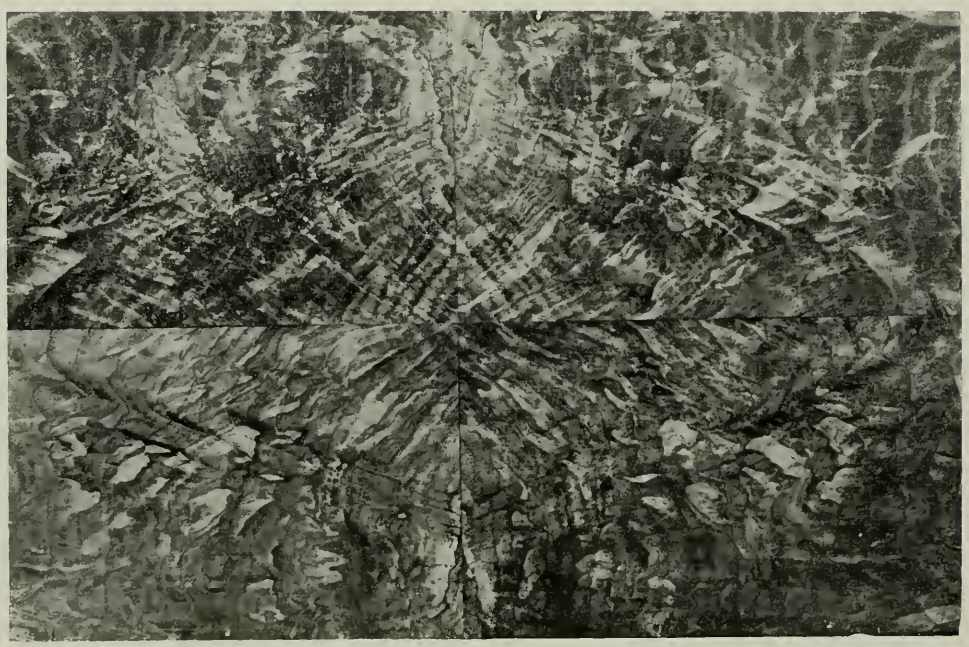


Fig. 7. Veneered Quartered Panel of Scottish Ash.

missioners on the subject of the advancement of afforestation in Scotland, and we were authorised to submit the following suggestions to you with the view of enabling your Commission, if so advised, to issue fresh proposals for consideration:—

"1. We were informed by your representatives that the Treasury was not disposed to find money for the purchase of land for afforestation. We therefore dropped a very modest scheme which we had prepared in hopes of getting a start made without delay—a scheme which would have cost the country less in five years than the price we pay for imported timber in a single day. It is suggested, however, that the objection to the purchase of land might not apply if payment of the price were made by annual instalments extending over a period not exceeding fifty years.

"2. It appears that the leasing scheme outlined in the Memorandum issued by the Board of Agriculture in November 1914 is not acceptable to landowners, mainly because they cannot as a rule afford to do without some annual payment to account of their interest in the undertaking. It is suggested that the lessee should offer to pay the rent at present appearing in the Valuation Roll during the currency of the lease, and also a bonus or percentage on the profits of the undertaking, with the object of inducing the landowner to take a helpful interest in the venture. The landowner should, of course, be bound to pay all the owners' taxes.

"3. It might be advisable to make clear in any future Memorandum what use the lessee would desire to make of existing estate machinery (subject to supervision) for the purpose of carrying on the work.

"4. If only existing woodland is to be dealt with, claims for compensation should not arise, but if land is taken which is occupied by any existing industry or interest, some compensation might be necessary to recompense the person disturbed or displaced, and this would form a charge on the new industry.

"5. It is assumed that all land included in the scheme will be properly forest land, which should, therefore, be kept under forest in perpetuity, and that this is the explanation of the provision that the landowner must, at the termination of the lease, either take over the lessee's share of the crop at valuation, or continue the lease. Would the continuation be on the same terms or subject to adjustment of rent?

"As you are aware, the Society does not claim to speak on behalf of the landowners of the country, but these suggestions are put forward with the view of endeavouring to have the former proposals brought more into line with what are known to be their views, in the hope that an arrangement may be arrived at which will induce landowners freely to take advantage of the terms offered.—I am, Sir, your obedient servant,

"R. GALLOWAY,
"*Secretary.*

"The Secretary,
"Development Commission,
"6A Deans Yard,
"Westminster, S.W."

To the above letter the following reply was received:—

"6A DEANS YARD,
"WESTMINSTER, S.W.,
"*20th April* 1916.

"Sir,—I am directed by the Development Commissioners to acknowledge the receipt of your letter of the 14th instant, which they will carefully consider.—I am, Sir, your obedient servant,

"G. STAGG,
"*for Acting Secretary.*

"The Secretary,
"Royal Scottish Arboricultural Society."

16. The Denizens of the Forest.

By Lt.-Col. MARTIN-MARTIN.

In our forest literature, and probably rightly, the premier place is given to insects and the no less important microbes. As the saw says—

Greater fleas have little fleas
Upon their legs to bite 'em,
And little fleas have lesser fleas,
And so—*ad infinitum.*

Such an extended range, and my own limited qualifications, prevent me even commencing an inquiry which leads so far.

At the other end of the scale there are the human inhabitants of forests whose conditions of life, mode of lodging, reward and promotion—whose sociology in fact—demand and we may hope will receive a full examination when forestry at home leads to the plantation of such human colonies as now only exist in the more extensive woodlands to be found abroad.

There remain mammals and birds, and it is on these two classes of denizen that it appears most apposite to dilate to some extent with the object of stimulating general discussion as to which species should be encouraged, and which discouraged or prohibited in the woodlands of the future. Mammals claim priority, and domestic animals are primary in necessity.

Whatever development may be made in machinery and mechanical power, forests can hardly in the future dispense with the horse, and at a time when encouragement to horse-breeding has become a national necessity (in view of future possible wars if for no other reason), it is pleasant to remember that forestry will always, as far as can be foreseen, demand and maintain the horse and pony as an essential part of labour. Sheep and cows will undoubtedly not only benefit from the shelter of adjacent woods, but will utilise the forest when sufficiently grown for grazing at certain seasons, and for its assistance in wintering. Continental example must be our guide as regards sheep and cattle in relation to forests.

Goats, on the other hand, are, in my opinion and experience, nothing else than a pest. Not only is their grazing destructive to every green thing within their reach, but the goat-herds soon learn to carry lances with a sickle at the end, and so assist in destroying what the goats would not otherwise reach, and, in addition, the goat-herds are a constant source of forest fires.

Pigs are far less objectionable to foresters, and their increase is a matter of national importance. In the Highlands of Scotland the inhabitants dislike them too much to promise that many will ever be kept in styes with all the unpleasant attention they require, and this prejudice, which is a sign of instinctive refinement, is one to be respected.

In droves in the forest, however, the pig is not nearly as unpleasant, and when the forest is of oak or sweet chestnut there is no more profitable use to be made of acorns and chestnuts than as food for pigs. Spanish hams owe their flavour and value solely to the chestnut forests of Spain.

Wild mammals are a much larger group, and fall naturally into two classes, both desirable economically as yielding profit, viz., game animals which yield both food and in some cases sporting rents, and fur-bearing animals valuable for their pelts which constantly appreciate in price. Of the first class roe-

deer are generally considered a pest akin to the goat, and undoubtedly squirrels in the second class are an equal nuisance.

The remainder are desirable in varied degree. Red deer can usefully shelter in fairly grown forests when so habituated, and fallow-deer take to them naturally. Rabbits are only tolerable in warrens wired in, and hares are negligible.

In Canada and Siberia, farms are already started in which the more valuable fur-bearing animals are reared, and from which they are turned loose. As the common fox produces a skin worth little or nothing, and other varieties of foxes' pelts fetch fabulous sums, it is evident that details are worth study.

The same might be said of the otter, marten and other varieties. In the earliest records of Inverness borough, which only date back three to four centuries or a trifle in time, the chief trade was in beaver skins. It is therefore quite obvious that the reversion to forest of any considerable areas in Scotland would permit the re-introduction of the beaver.

Whether it would be profitable or desirable to attempt this is quite another matter, but a matter of the exact kind which is now well worth study and decision in estimating the future productive value of forest areas.

Birds, again, may be divided for present purposes into two classes, viz., those called game birds, which are also useful for food, and the remainder.

With extensive forests the moorland or red grouse would naturally disappear on the areas planted, but this does not exhaust the whole grouse family. I have shot grouse in woodlands by Lake Ontario, but am not sufficiently a naturalist to know whether this was the "Willow Grouse" of America or another species. Similarly in the Himalayas I have killed tree partridges, locally called "Bahn Titas," in thick forest, it being chiefly met with in woods of oak and rhododendron.

Pheasants would increase in forests, especially if care were taken to plant some undergrowth bearing berries for their sustenance in winter. Wild turkeys might again very possibly be acclimatised, as well as other varieties, and the caper cailzie would thrive in woods of conifers. Black game are condemned as destructive, as Lord Lovat admits.

Outside game-birds there are only those valuable for their plumage, or for the destruction of noisome insects.

The latter have always been encouraged in every way in some Continental forests, even to the extent of placing artificial nests in woods to encourage their settlement, and tend to an abatement of insects, grubs, larvæ, etc.

The attitude of each individual towards the encouragement of game, whether furred or feathered, must to a large extent be coloured by his views as to "sport," especially in Scotland.

Independently of sport, game possesses a food value, which is considerable at all times, and sometimes essential in sickness and in hospitals; it is also economically a by-product of forestry which increases the value of the industry without harming it in any way, if judiciously controlled.

A moderate attitude towards "sport" as such, and in Scotland, appears to be something as follows:—

Sport is a valuable recreation, a means of considerable employment of labour, and a by no means negligible source of food. But if carried to such excess that all the best houses in the Highlands are only shooting-lodges, only occupied two months in the year and vacant for ten, and reserved (as well as huge areas around them) for generally absentee tenants or proprietors among the sporting and idle rich, drawn from elsewhere to supplant a native and resident gentry—then such sport is nothing but a curse to a country.

It is because forestry promises to win back these vacant areas to carry profitable crops (of timber), and to support in comfort and sufficiency by means of industry a large resident population of all classes, that this industry so appeals to all who have the welfare of our country at heart. But it by no means follows that planting, however extensive, need imply that animal and bird life should be totally extinguished in its glades, nor even that wholesome sport need be even lessened.

Afforestation, however, is bound to bring change to future denizens; they cannot be the same as those of the heath and the moorland. It is as well to consider now in what manner these changes will be guided and introduced, and in a more thorough and scientific manner than has been attempted in these few paragraphs, which can only serve, at the best, as suggestions for more capable treatment of a fascinating and all-important detail of woodland interests.

17. Some Observations on the Entomology of the Scots Pine.

(With Two Plates.)

By James W. Munro, B.Sc.

During the past four years, the writer has had many opportunities of studying insect life in the forest, and especially in our Scots pine woods. In view of the comparatively small attention paid to forest insects and their depredations in our woodlands in this country, and especially as the literature concerning them is scattered, and is in fact largely German, it is thought that the following notes and observations may be of interest. In the present paper these are confined to the insect enemies of the Scots pine, and among them to the Coleoptera or Beetles.

Of all our Scottish timber trees the Scots pine probably supports the largest number of insects. This is not surprising when we consider that it has been for long years the chief timber tree. It is, moreover, an indigenous species, a fact which is itself sufficient to account for its being the host of a considerable number of insects. Of the Coleoptera alone it supports twenty species belonging to eleven genera. Four families are represented—Cerambycidæ, Anobiidæ, Curculionidæ, and Scolytidæ, *i.e.* longicorns, woodborers, weevils, and bark beetles. Many of these beetles are to be found only on the Scots pine, and others of them prefer it to their other hosts such as spruce.

In the following account only those species which are of economic importance, or which, under favourable conditions, may be expected to prove of economic importance, have been considered. This reduces the number of families under consideration to two, namely, Scolytidæ and Curculionidæ, the bark beetles and the weevils.

The Scolytidæ attacking Scots pine are comprised in the two tribes, Hylesinina and Dryocætina. The representatives of these tribes differ in one easily recognisable feature. In the Hylesinina the head is not covered by the pro-thorax when the beetles are viewed from above. In the Dryocætina the head is so sunk in the pro-thorax as to be completely hidden by it. These characters are readily seen in *Myelophilus piniperda* and

Pityogenes bidentatus, two of our commonest pine beetles (Plate XII. figs. 2*b* and 4*b*).

The tribe Hylesinina consists of eight genera, only two of which, however, call for consideration here. These are the genus *Myelophilus* and the genus *Hylastes*. These two genera can be recognised by the number of joints in the middle part of the antennæ, known as the whip, and in the shape of the apical part or club. In *Myelophilus* the whip consists of six joints, and the club is roundly ovate. In *Hylastes* the whip is seven-jointed, and the club is ovate but slightly acuminate (Figs. 1*a* and 2*a*). This is a somewhat difficult distinction to make in the field, and the general conformation of the beetles may have to be relied on. The members of the genus *Myelophilus* are somewhat larger, less cylindrical, and more hairy; those of the genus *Hylastes* are generally more elongate and narrow in form. In *Hylastes*, too, the pro-thorax is generally longer in proportion to the wing-covers. These, however, are only general and therefore somewhat doubtful distinctions, and for certain identification of the genera the antennæ must be relied on.

The genus *Myelophilus* is represented by two species, both of which occur on Scots pine, namely, *Myelophilus piniperda* and *Myelophilus minor*. Only the first of these, so far as is known, is generally distributed in Scotland, and it will be sufficient to indicate its chief point of difference with *M. minor*. This lies in the wing-covers or elytra. In *M. piniperda* the row of bristles lying in the second interstice or groove of the wing-cover is not prolonged to the apex, but stops just a little behind. In *M. minor* this row of bristles is continued right to the apex.

The genus *Hylastes* is represented by five species, only two of which, however, appear to be common on Scots pine, namely, *Hylastes palliatus* and *Hylastes ater*. *H. palliatus* is the smaller beetle, and in general appearance it is stouter and shorter than *H. ater*. It is brown in colour, and the pro-thorax is bluntly pear-shaped. *H. ater* is long and cylindrical in appearance, and is, when fully matured, dull black in colour. In it the thorax is narrowly oval in shape.

Of the Dryocætina tribe three species belonging to three different genera are the commonest representatives, namely, *Trypodendron lineatum*, *Tomicus acuminatus*, and *Pityogenes bidentatus*. *T. lineatum* is included here less on account of its economic importance than on account of its peculiar habits. In

Trypodendron the whip of the antenna is four-jointed, and the club instead of being rounded is angular and is devoid of sutures, being closely covered with hairs or bristles.

In *Tomicus* and *Pityogenes* the whip of the antenna is five-jointed, and the club is roundly oval. Three wavy rows of bristles take the place of sutures.

The difference between these two genera is, to the layman at least, very slight. It lies in the underside of the pro-thorax, called the pro-sternum, to which the first pair of legs are attached. Between the coxæ, or first joints of the legs, there is in *Tomicus* a small but distinct angular process which is absent in *Pityogenes*.

The most common representative of the genus *Tomicus* is *T. acuminatus*, while *P. bidentatus* is probably the commonest *Pityogenes*. The two beetles are easily distinguished. In the first place *T. acuminatus* is twice the size of *P. bidentatus*. It is yellowish brown in colour. *P. bidentatus* is dark brown or black. Further, the wing-covers in the two beetles differ very markedly. In both they are scooped out at the apex, and the outer edges are armed with short tooth-like projections. In the females these teeth are less marked or absent as in *P. bidentatus*. *Tomicus acuminatus* bears three short teeth on each wing-cover. In the female all three teeth are simple. In the male the middle tooth is double (Fig. 3*b*). In *Pityogenes bidentatus* each wing-cover, in the male, bears a well-marked hook-like tooth.

The above short descriptions may help the forester and others interested to identify our commoner pine scolytids, but the beetles may also be identified by the nature of their work. With the exception of *Trypodendron lineatum*, all the beetles described above are bark dwellers, breeding between the bark and the sap-wood, where they construct their peculiar tunnels or brood galleries.

In the above description the genera *Myelophilus* and *Hylastes* have been classed together, and again *Tomicus* and *Pityogenes*. It is interesting that, if we except *Myelophilus minor* and base our classification on the galleries, we get an exactly similar grouping. Thus *Myelophilus* and *Hylastes* are both monogamous, and both make simple vertical mother galleries. *Tomicus* and *Pityogenes*, on the other hand, are both polygamous, and in both genera the galleries consist of a central nuptial chamber from which ramify three, four or five mother galleries (Fig. 9).

1a

2a

1b.

1c.

2b.

3a

4a.

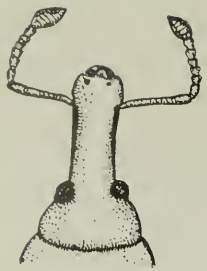
4c.

3b

4b

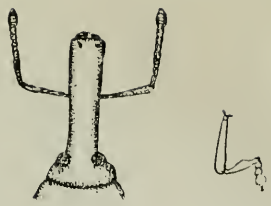
THE ENTOMOLOGY OF THE SCOTS PINE.
(For explanation see text, p. 122.)

[*To face p.* 116.



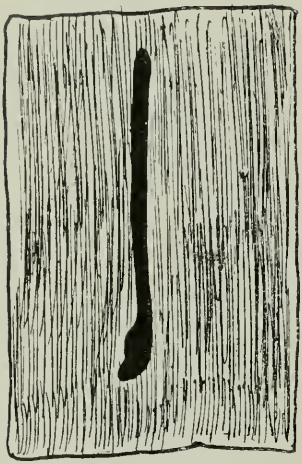
a. b.

5.



a. b.

6.



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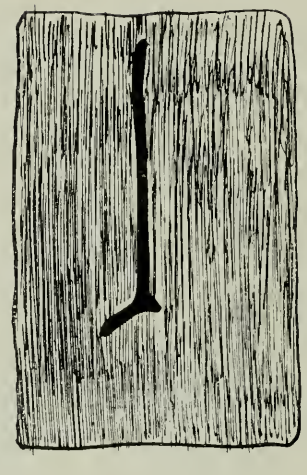
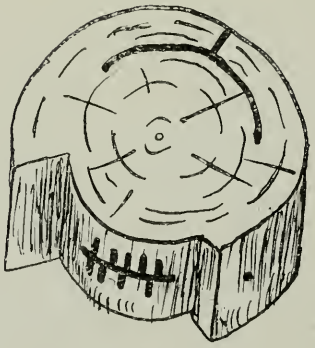


8.

9.



10.

For explanation see text, p. 122

Again, the gallery of *M. piniperda* differs from that of *Hylastes* (*H. palliatus*, for instance). This difference consists in the shape of the nuptial chamber, which in *Myelophilus* is like the end of a golf club and in *Hylastes* like a crutch (Figs. 7 and 8). In *Tomicus* and *Pityogenes* the differences are less marked, consisting only in greater breadth and length in *Tomicus* as compared with *Pityogenes*.

The galleries of *Trypodendron lineatum* cannot be confused with those of any other Scots pine scolytid. *T. lineatum* is not a bark-dweller. The female bores her galleries directly into the wood, boring straight in at first and then forming a curved T-shaped gallery, as shown in Fig. 10. This gallery is horizontal. The larval galleries arise above and below it in a vertical direction, presenting the ladder-like appearance seen in the vertical section.

A word of caution must be given regarding the identification of the scolytids from their brood galleries. In many instances such identification is highly useful, but unfavourable circumstances, such as too dry breeding ground or variations in the thickness of the bark, may cause very considerable variations in the shape of the mother galleries. This applies especially to *Myelophilus* and *Hylastes*, and in a less degree to *Tomicus* and *Pityogenes*, although the writer has in his collection a mother gallery, from the eggs of which *T. acuminatus* were reared, which is indistinguishable from the simple one-armed gallery of *M. piniperda*.

Of the Curculionidæ or Weevils, only two genera come under consideration in this account, namely, *Hylobius* and *Pissodes*. The genus *Hylobius* consists of only one species, the well-known *Hylobius abietis*. Of *Pissodes* two species occur on Scots pine, *P. notatus* and *P. pini*. The first of these appears to be comparatively rare in Scotland, but *P. pini* is almost universal in its distribution. The members of the two genera are readily distinguishable from one another. In *Hylobius* the antennæ are inserted near the apex or tip of the rostrum or snout, and the femora or third joints of the legs are toothed. In *Pissodes* the antennæ are inserted at the middle of the rostrum, and the femora are not toothed (Figs. 5 and 6, *a* and *b*). On contrasting *Hylobius abietis* and *Pissodes pini* as regards general appearance, it will be seen that *Hylobius* is much the larger beetle, that it is stouter and rounder in form, and, except for

the yellow flecks on the elytra and thorax, is of a uniform brown colour.

The weevils differ from the bark beetles in one important biological feature. They make no mother gallery, and their eggs are laid either singly as in *Hylobius*, or in groups as in *Pissodes*, from outside the bark, being deposited through a hole gnawed for the purpose.

In other respects the biology of the two families is somewhat similar. The members of both are long lived and indulge in recuperative feeding; that is, they renew their reproductive capacity by a period of restful feeding between their flight periods. This is one of the most interesting and important features of their biology. The well-known and very injurious damage done by the adult *Hylobius* in young plantations, the boring in the young pine twigs so typical of *Myelophilus*, the gnawing of the younger twigs and branches by the adult *Pissodes*, all these are a preparation for reproduction.

Accordingly the work or "damage" of our pine beetles is divisible into two distinct types—the damage, or to use a most useful, if vague, term, the frass, caused during the breeding period, and during the feeding or recuperative period. Now it is noteworthy that in many cases the "breeding" ground of a species is not necessarily its "feeding" ground. *Hylobius* "feeds" on young, newly-planted conifers, and even on birch and oak, but it never breeds on these. Its "breeding" ground is the Scots pine stump. So too with *Myelophilus*. It "feeds" on the young pine twig, but it breeds in the stem. The same is true of *Hylastes ater*, which is strangely similar to *Hylobius* in its life-history. It "feeds" on young conifers and breeds on the Scots pine roots. As I hope to show later this feature in the biology of these beetles is of the first importance in dealing with our pine beetle problems.

From the point of view of the forest entomologist, the Scots pine may be divided into three regions, namely, crown and branches, stem, and stump and roots. Each of these regions has its peculiar beetles.

In the crown the following occur:—

(*a*) Breeding—*T. acuminatus.*
P. bidentatus.
(*b*) Feeding—*M. piniperda.*
P. pini.

In or on the stem the following occur :—

(*a*) Breeding—*H. palliatus.*
M. piniperda.
P. pini.
(*b*) Feeding — *H. palliatus.*
H. abietis (young pines only).

On the stump and roots occur :—

(*a*) Breeding—*H. abietis.*
H. ater.
(*b*) Feeding — *H. palliatus.*
H. ater (on young pines only).

It is seldom that all these species are found on any one pine, or even in any one pine wood. In some woods only one species may be present, or all but one. In the normal, or rather the average, Scots pine wood, the majority of the species occur, but on different trees and in different localities at any given period. This may be due to several causes, the chief of which, however, is the fact that each species or group of species attacks the pine under particular conditions, and only under these conditions. It is generally known that only rarely do the bark beetles and the weevils attack trees in full health. As a rule our pine beetles prefer sickly trees. They do not, however, prefer the same reduction of vitality; one species will attack on the first signs of weakening vitality, another will follow on the heels of this species when the vitality has been further reduced, while others will delay even longer. Thus *Myelophilus piniperda* is usually the first to attack. It is followed by *H. palliatus* and *Pissodes.* All these attack the stem. On the stump and roots *Hylobius* is first to attack, then *H. ater* follows it. In a sickly standing tree, the following is the sequence I have observed most frequently :—

1. The stem is attacked by *M. piniperda.*
2. The stem is attacked by *H. palliatus*, and the stump and roots by *Hylobius.*
3. *Myelophilus* has gone from the stem, *H. palliatus* and *Pissodes pini* remaining. *Hylobius* remains on the roots accompanied by *H. ater. Pityogenes bidentatus* is appearing on the twigs.
4. The stem is quite deserted. On the roots *Hylobius* is rare, while *H. ater* is increasing. *P. bidentatus* is

abundant, and in certain localities is accompanied by *T. acuminatus.*

5. The tree is deserted except by ants, fly larvæ, centipedes, spiders, etc.

Such is a brief history of the invasion of a Scots pine by its enemies. Now this sequence of insects is a very important point in forest protection. Its moral undoubtedly is, the longer you neglect to adopt preventive and remedial measures, the more pests you are going to have to fight. So far only the occasional sickly stem has been considered, and it may be argued that sickly stems are easily removed and the wood thereby freed from further infection. This is largely true. There is, however, another aspect of the case, and it is this, that the Scots pine clearing is exactly comparable to the sickly standing stem as regards insect attack. That this is so is shown by the following summary of observations made on felled Scots pine areas during the past four years. A comparison of this summary with that given for the stem shows a striking similarity. The stem in this case is reduced to the stump. The crown, branches and roots, however, remain as before.

1. On the stump, *M. piniperda.*
2. On the stump, *M. piniperda* and *H. palliatus.*
   On the roots, *H. abietis.*
3. On the stump, *H. palliatus.*
   On the roots, *H. abietis* and *H. ater.*
   On the branches, *P. bidentatus.*
4. On the stump, a few *H. palliatus.*
   On the roots, *H. abietis* and *H. ater.* Both now attacking the smaller roots deep in the ground.
5. *P. bidentatus*, abundant. *H. ater*, few.
6. Stumps, roots and branches deserted except by ants, centipedes, etc.

The period of time from the first to the last stage in this sequence is from three to five years, according to the age of the trees when felled, the wetness or dryness of the soil, and the weather conditions.

Stage 1 begins immediately on felling.

Stage 2, nine months to a year later.

Stage 3, six to nine months later; while

Stages 4, 5 and 6 follow in the next year and a half to two years.

From the point of view of the forester, I have heard it urged that the felled area is no longer of interest to him. As a timber-producing area, the clearing does for a time cease to interest him; but if it does, it is because he is short-sighted. He probably is going to replant it, and it is more than likely that his clearing is not altogether isolated. If he is working according to a working-plan, it is probably not far distant from a newly formed plantation or other young woods. Now the felled area has a direct bearing on the health of these plantations. In the clearing a number of forest pests have been breeding, but, as I have stated, they also feed. They do not feed, or only one or two species of them do, in the felled area, but they do feed in the newly formed plantation and the growing young woods.

Trace the beetles from the felled area, and the following migrations will be observed :—

1. To the newly formed plantations. *Hylobius abietis* is feeding on the young stems and nibbling the leading buds. *Hylastes ater* is feeding below soil on the young roots and that part of the stem which careless planting may have left below ground.
2. To the young wood, 15–20 years old. *P. bidentatus* is feeding on the stems 3 to 6 feet above the ground. *M. piniperda* is boring in the leaders.
3. To the woods aged 20–40 years. *H. palliatus* is feeding in the crowns, as is also *Pissodes pini*.

Now this is rather an extreme case, but it is strictly true to say that two out of the three of these migrations are going on from the majority of our Scots pine clearings. The evidence is available to any one who is interested enough to look for it.

Thus far my observations have led me, but it is permissible to look further ahead. From the young plantations, *Hylobius* and *Hylastes* soon emigrate, but in the other older woods, *Pityogenes*, *Myelophilus*, *H. palliatus*, and *Pissodes pini* are perhaps preparing a new breeding ground by producing sickly stems, and the cycle may be renewed. Of that, however, I have no proof.

The foregoing observations, it is hoped, may serve to increase interest in our forest insects among those engaged in forestry. They can be confirmed by any one who will take the trouble to acquaint himself with the characters and life-histories

of our commoner species, and they undoubtedly condemn the too prevalent system of clear cutting, which leaves the clearing littered with branchwood and stumps. Unfortunately for the private owner, it is almost impossible to clear land of worthless branchwood and stumps, which are costly and difficult to remove. All the more then is it important to realise that the felled area is a source of evil which, if extensive and scientific forestry is ever to be a success, must be removed. Meantime there is much room for workers in forest entomology, especially for those who can make observations in their daily work. At present our knowledge of the distribution of our chief forest pests, and of the actual financial loss caused by them, is very vague, and all observations relating to these will be of great value.

Explanation of Plates.

Plate I.

Fig. 1*a*. Antenna of *Hylastes ater*, showing seven-jointed whip.
,, 1*b*. *Hylastes palliatus*, showing pear-shaped pro-thorax. × 6.
,, 1*c*. *Hylastes ater*, showing long, narrow pro-thorax. × 6.
,, 2*a*. Antenna of *Myelophilus piniperda*, showing six-jointed whip.
,, 2*b*. *Myelophilus piniperda*. × 6.
,, 3*a*. Underside of pro-thorax (pro-sternum) of *T. acuminatus*, showing intercoxal process.
,, 3*b*. *T. acuminatus* (male). × 6.
,, 4*a*. Underside of pro-thorax, showing absence of intercoxal process.
,, 4*b*. *P. bidentatus* (male). × 12.
,, 4*c*. Antenna of *P. bidentatus*, showing five-jointed whip.

Plate II.

Fig. 5*a*. Snout of *Hylobius*, showing antennæ inserted near apex.
,, 5*b*. Fore leg of *Hylobius*, showing toothed femur.
,, 6*a*. Snout of *Pissodes*, showing antennæ inserted at middle.
,, 6*b*. Fore leg of *Pissodes*, showing absence of tooth on femur.
,, 7. Mother gallery of *Myelophilus piniperda*.
,, 8. Mother gallery of *Hylastes palliatus*.
,, 9. Mother galleries and breeding chamber of *Pityogenes bidentatus*.
,, 10. Mother and larval galleries of *Trypodendron lineatum* shown in transverse and vertical section.

18. Australian Forestry.

By D. E. Hutchins.

Last month there had to be recorded the most important step that has yet been taken in systematic forestry in Australia since the passing of the Victorian Forest Act and the initiation of an efficient Forest Department in Victoria eight years ago. In March 1916, Mr Lane Poole, a graduate of Nancy, was appointed to the post of Chief Forest Officer in West Australia.

Since the death of the late Mr Ednie Brown, some twelve years ago, the post of Chief Forest Officer in Western Australia has remained vacant, being filled temporarily by the Chief Clerk. The West Australian Government has advertised for applications on more than one occasion; but, owing to a change of Government and other causes, no decision had been arrived at.

Mr Lane Poole is a full-time graduate of the Nancy Forest School: and in 1905 passed through the school of extra tropical forestry in South Africa. He was then appointed to the Transvaal, and after three or four years' service in South Africa transferred as Chief of the Forest Administration at Sierra Leone, which post he has held until his present appointment in West Australia.

As is well known, the West Australian Government has State forests, mainly Jarah, of great value. At this day the largest outturn of timber in Australia is from West Australia, and the timber export of West Australia is about equal to that of the whole foreign timber export of the Australian Commonwealth. The West Australian forests are being energetically worked both by Government and the private grantees that have now mostly come into the "Millars" combine. West Australia is the only Australian Government at present working the national forests, and it is doing this with two large modern well-equipped mills and a branch line of railway. This is in the Kari forests. The Kari forest is difficult to destroy, even if the Government wished to do so. Under ordinary circumstances its cutting removes a quantity of over-mature timber, and its place is taken by a regrowth very similar to the Kari plantations in South Africa. The bulk of the timber and timber working is in the Jarah forests. The Jarah forests of Western Australia admit of easy administration on scientific lines. They are accessible, easily protected from fire, free from the rabbit pest, and, most important of all, are commonly on land which when it carries Jarah carries

its most paying crop. As far as I was able to judge it would be a comparatively easy matter to organise, to fire protect, and to fill up with pine the present half-empty Jarah forests. A shade-bearing conifer mixed with the Jarah would not only double or treble the value of the Jarah forest, but would improve the Jarah itself in the straightness of the timber and the better growth following on improved soil conditions. Pines would probably also spread themselves freely when once well introduced, as does so much of the stronger vegetation of the Northern hemisphere in Australia and New Zealand.

The forest question of Australia has in recent years become one of the most important social questions before the country. With the reckless destruction of the home forests, the bill for imported timber has been going up by leaps and bounds. When the war broke out Australia was paying in round numbers at the rate of £3,500,000 yearly, or nearly £1000 a day, for imported timber; and this had to be brought almost entirely from the other side of the world. With the equally reckless forestry of New Zealand, it must, in a few years, come entirely from the other side of the world. The imported timber of Australia in bulk represented the load of a good-sized steamer arriving daily: about 50 million cubic feet yearly.

If to this bill of £3,500,000 yearly for imported timber one adds (1) the loss of the greater part of the hardwood market of Europe which, with better forestry, Australia might have easily captured, (2) the failure of timber for home use (native timber for house building has doubled in cost during the last fifteen years owing to the destruction of most of the accessible forests), we arrive at the startling conclusion that under normal pre-war conditions the reckless forestry of Australia is already costing the country some £8,000,000 yearly. This figure is made up thus:—

Timber importation, normal before the war .	£3,500,000
Loss of export trade in hardwoods . .	2,500,000
Shrinkage of home production—house timber, fencing posts, railway sleepers, etc.—increasing the cost of house-building, farming, railways, and living generally . . .	1,000,000
Indirect loss to various industries owing to the rise in cost of the raw materials, timber and tan-bark; a rough estimate of the minimum loss	1,000,000
Total .	£8,000,000

These figures include tan bark but not paper pulp or paper. Paper pulp is little imported now, but is to be soon on a considerable scale. Australia is now losing about £250,000 yearly over tan wattle bark. This is included in the total of £8,000,000.

These figures are founded on the published official statistics. They are discussed at page 259 of my "Report on Australian Forestry" which is now before the Government of Western Australia.

It must be remembered that Australia never had any large area of good forest, such as have countries with a more abundant rainfall like North America; and that in following the American example of an *indiscriminate* clearing of the forest for settlement, Australia was following a suicidal policy like cutting the dykes of Holland and letting in the sea. In my West Australian forest report, mentioned above, is given a rainfall map showing that the total area of country in extra-tropical Australia with a rainfall sufficient to carry good timber was never more than 1½ times the total area of the British Isles; and of this area only a fraction could economically be spared for the permanent forests of the country. What that fraction was should of course have been determined by a national forest demarcation. Ribbentrop, Vincent, and every Indian forester who visited Australia exhorted forest demarcation. Gamble, when editing the *Indian Forester* and reviewing Australian administration reports, urged it repeatedly. But their warnings were lost in the whirl of parochial politics, and now comes the consequence which the present generation has to face.

I have calculated that if Australia were to do now as South Africa did in 1883 and put its forests in order, it would take some thirty years to do so; that is to say, before Australia could supply its wants in hardwoods and softwoods, during the thirty years there will be an inevitable loss (allowing interest at 4 per cent.) amounting to the huge figure of £588,000,000. This is the sum which Australia must inevitably lose through its neglect of forestry in the past; and, of course, the longer Australia delays putting its forests in order the greater will be the inevitable loss before it can get square with its forestry. One must remember that forestry in Australia is not merely a question of growing its own timber or buying it from a neighbour. There is no neighbour. The great waste of waters in the Southern Hemisphere affords no escape from the con-

sequence of reckless forestry. Australia must either produce its own timber or import it, at incredible cost, from the other side of the world.

And the pity of the whole matter is intensified when one comes to see, as I have during the last two years, what fine forests Australia can produce. I have measured and photographed Eucalypts 300 feet in height. There are measured samples of Kari and Eucalypt regnant forest with at least 20,000 cubic feet per acre of sawable milling timber. The present evidence is in favour of Eucalypts being the tallest tree in the world, and the *Sequoias* being the bulkiest. Sawmillers have taken £500 worth of timber off a single acre of Blue-gum forest in Tasmania. But with all this potential forest wealth, Australia when the war broke out was importing 50 million cubic feet of timber yearly, and exporting only 12 million, while every hot wind takes its toll of blackened and ruined forests.

WELLINGTON, N.Z.
April, 1916.

19. A New Steam Tree-Feller.

(*With Plate.*)

By JOHN SCRIMGEOUR.

During the last two years great activity has prevailed in the home timber trade. The woodlands of Scotland have been drawn upon largely, and their owners have benefited by the enhanced prices. The patriotic landowners, who planted under by no means encouraging conditions, are now getting well deserved rewards. These are times when it behoves everyone to consider how the labour bill can be reduced and timber put on the market at the smallest possible outlay. In view of the ever-increasing shortage of skilled labour, it is important that proprietors, foresters and timber merchants should look for and encourage the most up-to-date labour-saving machinery.

Whilst there seems to be no end to the number of ingenious machines continually being designed for the more rapid conversion of timber in the sawmill or joiner's workshop, the felling in the forest has till now been all done by hand. In felling the heavier timber trees, and especially hardwoods, the brain and brawn of the woodmen have too often been taxed to their utmost

ere the stately, handsome tree was brought safely, undamaged and undamaging, to the horizontal. The need for some mechanical means of felling has long been felt. This need has been met in a most satisfactory form by the Ransome Patent Steam Tree-Feller, which has been most successfully used in Scotland during the last six months, by the firm of Messrs Hugh Campbell & Sons, Doune, Perthshire.

The machine, which weighs about 4 cwts., consists of a steam cylinder of small diameter, having a long stroke, attached to a light wrought-iron frame upon which it is arranged to pivot on its centre, the pivoting motion being controlled by a hand wheel turning a worm which gears into a quadrant cast on the back of the cylinder. The saw is fixed direct to the end of the piston rod, which is made to travel in a true line by guides, and the teeth of the saw are of such a form as to cut only during the inward stroke. Steam is supplied at a high pressure from a portable boiler through a strong flexible steam-pipe 120 feet long, which enables a considerable area to be felled without it being necessary to shift the boiler.

In operation the tree-feller is placed on the ground close to the tree, and is held fast by a strong screw to a trident-pointed bar, which is driven firmly into the tree at the ground level under the saw, by a few blows of a sledge-hammer. The saw is steadied by hand for the first few strokes, until it is buried in the tree, when wedges are driven into the tree to prevent the saw being pinched, and to help to throw the tree in the desired direction.

The actual time for cutting of oak logs averaging 30 inches in diameter is from three to four minutes, while oak trees 48 inches in diameter (the full capacity of the machine) have been cut in less than ten minutes, the trees being all sawn off practically at the ground level. It is also a distinct advantage that the tree-feller will cut through the tree from right to left, or from left to right, as desired, by turning the saw upside down in its socket so that the teeth face in the desired direction.

By shifting the cylinder into a cross-cutting frame, the logs can be quickly cut to the required lengths, and many of the large limbs can be cut off neatly close to the trunk.

The cost of the machine in September 1915, including cross-cutting frame, four saws, and 120 feet flexible steam-hose was £90, but the makers' prices will probably now be much higher.

A special portable boiler for supplying steam to the machine was also quoted at that time at £113, 10s.

When the machine was first offered for sale, the makers anticipated that it would require four men to remove it from tree to tree owing to its weight. Messrs Campbell got over this difficulty somewhat easily, as they ingeniously fastened a wrought-iron axle to the machine to which they fitted two removable wheels, thus enabling two men to transport it easily over rough and sodden ground to the next tree to be felled. It may be added that the cut made by the saw is exceptionally clean and smooth.

A special portable boiler was not required by Messrs Campbell, as they already possessed a seven horse-power traction engine which proved an efficient substitute. As the traction engine is fitted with a wire-rope hauling apparatus, it was used for turning heavy logs to enable the limbs to be more easily dressed off, and for loading carts and waggons.

Messrs Hugh Campbell & Sons, with the concurrence of Messrs Ransome, arranged that the tree-feller could be seen working on the 18th February last, whilst a plantation of large-sized oaks was being felled on the Ochtertyre estate, about midway between Doune and Stirling. Unfortunately the day proved unfavourable, and the demonstration took place during a heavy snow-storm. Notwithstanding, it was clearly shown that very satisfactory work can be done, even under adverse weather conditions—one oak 46 inches in diameter being cut down in 13 minutes—and that a most useful and economic machine propelled by steam can now be used in timber felling operations. Amongst those present were Dr Borthwick, Edinburgh, and Mr Stewart of the Board of Agriculture.

The two photographs (Pl. XIII. figs. 1 and 2) show the machine at work, the position of the engine, and some of the trees cut.

The writer is permitted by the Messrs Campbell to state—and the information is interesting—that they very recently felled by the steam tree-feller eighty oak trees, the average contents of which were 50 cubic feet. They sold these trees at 2s. 6d. per cubic foot, delivered in Glasgow district. This makes an average of £6, 5s. per tree.

FIG. 1. THE STEAM TREE-FELLER AT WORK.

[*To face p.* 128.

Fig. 2. Tree cut by Steam Feller.

20. The Great War.

THE SOCIETY'S ROLL OF HONOUR.

Third List.[1]

Adamson, John, Forester, Bell's Yew Green, Frant, Sussex. Private, West Kent Yeomanry.

Ainslie, John R., Ceylon Forestry Service. Lieutenant, 4th Royal Dublin Fusiliers.

Balfour, R. A., Yr. of Balbirnie. Captain, Scots Guards. (Killed on 28th October 1914.)

Carmichael, J. L., jun., of Arthurstone, near Meigle. 3/1 Highland Light Infantry.

Chalmers, Robert W., Darnhall. Private, 3rd K.O.S.B.

Clark, F. I., Estate Office, Haddo House. 2nd Lieutenant, 3/5 Gordon Highlanders.

Clark, Wm., Douglas Estate Office. Private, 3/8 Royal Scots.

Dorington, Hubert, Lypiatt Park, Stroud. Lieutenant, Yorkshire Hussars.

Gammell, S. J., of Countesswells. Captain, R.G.A., for Anti-Aircraft Defence.

Gladstone, Lieut.-Col. Sir John R., Commandant of the Prisoners of War Camp at Holyport, Maidenhead.

Gourlay, Dr W. B., Dawyck. Lieutenant, R.A.M.C.

Haldane, David, Forester, Dalmeny. Private, R.G.A.

Irving, James R. A., Forester, Meikleour. Private, 1st Garrison Battalion, H.L.I.

Law, Fred. W., M.A., B.Sc., Aberdeen. 2nd Lieutenant, 3/4 Gordon Highlanders.

Menzies, Geo. D., Estate Office, Penicuik. R.F.A.

Mitchell, J. I., M.A., Edinburgh. Q.M.S., 3/6 Royal Scots.

Moon, John L., Nairobi, B.E.A. Private, East Africa Regiment, Maxim Gun Section.

Moultrie, James, Durris, Drumoak. Private, 3rd Gordon Highlanders.

M'Callum, Alex., Forester, Kippendavie Estates, Sapper, R.E.

M'Glashan, Tom, Assistant Forester, Murthly. Royal Naval Reserve.

MacGregor, Evan M., Factor, Ard Choille, Perth. Captain, Scottish Horse.

M'Intyre, Hugh, Dalzell. Private, 6th Cameron Highlanders.

[1] For First and Second Lists see Vol. xxix. p. 192, and Vol. xxx. p. 47, respectively.

Mackay, J. W., Jervaulx Abbey. Cadet, Artists Rifles, O.T.C.

Mackintosh, W. E., Younger of Kyllachy. Lieut., Queen's Own Cameron Highlanders.

Park, James, Assistant Forester, Durris. Private, 1/7 Gordon Highlanders.

Plenderleith, William, Stobo. Lance-Corporal, 4/2 Lowland Field Coy., R.E. (T.).

Reynolds, T. L., Darnhall. Sapper, 83 Field Coy., R.E.

Stuart, Alex. J., Lee Estates Office. Royal Engineers.

Corrections on Previous Lists.

Ralph, James Mackenzie, Corstorphine, 2nd Lieutenant, 3/4 Royal Scots, was entered by mistake under "Mackenzie" in the Second List.

Irvine, A. F., of Drum, entered in First List, is now 2nd Lieutenant, 4th Grenadier Guards.

The following two names should not have appeared in the body of the Second List, but under "Corrections" at the end.

Strathern, T. D., Kirkby Lonsdale. 2nd Lieutenant, 3rd Yorkshire Regiment.

Waddingham, J. H., Grimsby. Lieutenant, 2nd Lincolnshire R.F.A.

NOTES AND QUERIES.

Aberdeen Branch: Excursion to Craibstone.

By kind permission of the Governors of the North of Scotland College of Agriculture, the members of the Aberdeen Branch of the Royal Scottish Arboricultural Society were privileged to visit the proposed forest garden at Craibstone, on 31st July last.

The estate of Craibstone, situated some six miles from the city, was purchased by the North of Scotland College, some two years ago, as an experimental farm. In addition to the arable and grass lands, there are some 200 acres of woodlands in the estate. The Governors of the College have decided to utilise this area as an experimental forest garden, and certain steps have been already taken to further this object.

Professor Trail, President of the branch, and some thirty members and others interested in forestry took part in the excursion.

Mr P. Leslie, M.A., B.Sc., Lecturer in Forestry, Marischal College, acted as guide. During the walk from the lodge to the mansion-house, many good trees of several varieties, principally broad-leaved, were noticed, some of which, being of considerable size, seemed good subjects for arboricultural experiment. The general rally was at the mansion, from which point the whole company proceeded to make an inspection of the woodlands to the west, where they are principally situated.

The general plan proposed to be carried out by the Forestry Committee of the Governors was explained by Mr Leslie, but he further explained that while they had decided to convert the whole into a forest garden, the Development Commissioners had refused to sanction funds for an experimental area larger than 30 acres. Under these circumstances, it was proposed to proceed with the formation of a garden of this extent, and to manage the woodlands, as far as possible, on commercial lines, but it seemed a pity that it was not possible to take full advantage of the facilities afforded by the full possession of this property.

In this forest garden of 30 acres it is intended, in so far as the very limited area will permit, to test all indigenous and exotic forest trees as to their hardiness for this climate, and their general arboricultural and silvicultural suitability for the North of Scotland, regard being had in all cases, as far as possible, to soil, altitude and other local conditions.

Certain progress has already been made in this direction by the removal of the timber from the proposed area.

This is, shortly, a general outline of the scheme which, under the circumstances, commended itself generally to the practical foresters present. However, the whole scheme being as yet in an initial stage, it would be obviously unfair to express any definite opinion on it. The great difficulty seems to be the limited funds which the Development Commissioners are willing to grant even in ordinary circumstances, and especially at the present time when economy, owing to the war, is being practised in all public works. Until this state of things changes, we are afraid much further progress in such schemes must be stayed for the present.

The opinions generally expressed by the members present were entirely favourable to the scheme of the Governors, and the hope was expressed that at no distant date sufficient funds may be granted, and that a forest school may be established here worthy of Aberdeen and the North of Scotland.

Rabbits.

Rabbits are one of the forester's worst enemies, and do more damage to young trees than any other forest pest. How annoying it is to have bestowed the greatest care possible in the formation of young woods and plantations, and then to see the young trees gradually dying off, owing to the persistent nibbling of rabbits! All plantation fences should have at least 3 feet of 1½-inch mesh wire-netting on them, with 6 inches of the netting let into the ground. A continual watch must be kept to prevent holes being scraped through underneath. If rabbits are wanted for sport let them be confined to warrens or similar places where they can do no damage. Much of the damage done by rabbits, if not all of it, is put down to the forester's account instead of the gamekeeper's. In planting standard or specimen trees in the policies they have to be protected by a smear of some kind, and where that is not practicable they have to be enclosed in a wire-net cage half-way up the stem. In the case of rabbits, prevention is always better than cure, and the surest method of prevention is to have them killed.

Geo. Mowat.

Some Observations on Planting New Ground: Errata.

In Mr Boyd's article on this subject, which appears in the last issue of the *Transactions*, Vol. xxx., Part 1, pp. 27-33, the word *difficulty* on p. 32, ten lines from the bottom of the page, should read *difference*. The lines on the top of p. 33 should read as follows:—

"Until recently the writer believed in and practised late spring planting of Douglas fir and Sitka spruce, and it is a fairly popular belief, that to have successful results in transplanting these, the work, etc., etc."

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1915.—*Continued.*

THE GENERAL MEETING.

A General Meeting of the Society was held in the Goold Hall, 5 St Andrew's Square, Edinburgh, on Wednesday, 14th July 1915, at 2.30 P.M. In the absence of the President, Colonel STIRLING, on military service, Sir ANDREW AGNEW, Bt., the senior Vice-President, occupied the Chair.

MINUTES.

The Minutes of the last Annual General Meeting were held as read and adopted.

APOLOGIES.

Apologies for absence were intimated from the President, Lord Lovat, Mr John D. Sutherland of the Board of Agriculture, Dr Borthwick, Colonel Malcolm of Poltalloch, Sir Arthur Mackenzie of Coul, and Messrs Irvine of Drum, E. P. Stebbing, A. T. Gillanders, J. F. Annand, James Kay, George Fraser, John Wilkinson, Hugh C. Somerville, Peter Leslie, and J. M'Kerchar.

EXCURSION, EXHIBITION AND NURSERY AND PLANTATION COMPETITIONS.

The SECRETARY, Mr Galloway, reported that after careful consideration the Council had abandoned the annual excursion. The postponement by the Highland and Agricultural Society

of their Show necessarily involved the postponement of this Society's annual exhibition of forestry. The competitions for estate nurseries and plantations, while not so dependent as the Exhibition on the Show, were closely identified with it, as the competitions were always confined to the area of the Show, and the Council accordingly decided that they also should be postponed so as to keep them in the same rotation with the Show and Exhibition.

Mr Robert Allan, Convener of the Exhibition Committee, said that the Council regretted very much the temporary interruption of part of the Society's work owing to the war, and they hoped that those who had been making preparations for this year would reserve them for the future.

Judges' Report on Essays.

The Secretary reported that *two* Essays only had been received, and that the Judges' awards were as follows:—

1. "Comparison between Prices now being Realised for Timber in England and those being Realised in Scotland." By Alex. M'Pherson, Head Forester, Poltalloch Estate, Tayness, Kilmartin, Argyll. Award—a No. 1 Silver Medal.
2. "Species, including Exotics, found to be most suitable as Forest Crops in Localities which are unfavourable owing to various causes, such as High Elevation, Exposure to Strong Gales, Frosts, Bogs, etc." By the same writer. Award—a Bronze Medal.

Employment in Forestry for Women and Disabled Soldiers.

The Secretary reported that, owing to the scarcity of men to carry on forestry work, the Council had decided to try the experiment of employing women who had been deprived of their ordinary occupations by the war. A Committee of the Council accordingly arranged to co-operate with the Scottish Committee on Women's Employment in the matter, with the result that a large number of women had been placed in various parts of the country. The engagements were, of course, temporary, but there was reason to believe that many of the experiments had

been successful and would very probably have lasting results. The War Office had been communicated with regarding the employment of soldiers discharged as unfit for further service with the colours, and, as suggested by the War Office, this matter was now being taken up with the Labour Exchanges.

Mr J. H. Dods, factor, Novar, said that he had six fisher girls engaged on forestry work at Novar, and that they were giving every satisfaction. The result had been that some women in the district had turned out who were unwilling to undertake this work before. At Raith six or eight women were working, and they, too, were giving satisfaction to the head forester. It happened that the chauffeur's house was empty and the women were lodged there. He suggested that, when the war was over, the tin huts at present occupied by soldiers might be handed over for housing required in connection with schemes of afforestation.

Camps Afforestation Scheme, Employment of Disabled Soldiers and Sailors.

Sir John Stirling-Maxwell mentioned that the District Committee of the Upper Ward of Lanarkshire asked the Council to assist them, as far as possible, in the scheme of afforestation which they had undertaken in connection with their new water supply at Camps in Lanarkshire, and had invited them to send some members to look over the ground with them. Mr Galloway, Mr Macdonald, Mr Gordon and he accordingly visited the nurseries and buildings at Hairmyres, on the border of the industrial part of Lanarkshire where the men who came to them as consumptives were to be trained to country work, having previously been employed in industrial work. They afterwards proceeded to Camps, forty miles farther south, where the forest, an area of about 3000 acres, is to be planted round the reservoirs which are to supply the district with water. The site selected for this forest appeared to be extremely promising; the soil was excellent and the ground required little draining. The District Committee had further shown their good sense in recognising that expert advice was necessary in dealing with an undertaking of this kind. They also proposed to employ and train as foresters a number of disabled soldiers in connection with their afforestation scheme at Camps.

Chairman's Remarks.

The Chairman said:—"The next item on the paper is the Chairman's remarks. These will be very few, because I have no particular subject upon which to address you this afternoon. I would merely remind you how the war has necessarily interfered with every scheme of social development. The Government and the nation are so much occupied in considering how to bring the war to a successful issue, that they are unable at present to give very much attention to any of our social schemes. But the war has given us a far stronger case for Government help in the matter of forestry than we have ever had before; and it is our duty, therefore, in the meantime, to prepare for the end of the war. I think the war must have made quite clear to every one, even to all the authorities, to what a dangerous extent we have hitherto been dependent upon foreign timber. When the war began and the importation of timber was checked, the scarcity was immediately felt. The price of every article in which wood is required has gone up considerably. We have all had experience of this in our various ways. I might add one small example to the many examples great and small that you are already aware of. The Soldiers' and Sailors' Families Association with which I am connected have had lately to increase the grant that they give for funeral expenses, chiefly because of the rise in price of coffins. Then there is the question of pit-wood, the demand for which has been so great that there has been much difficulty in meeting it. Plantations have been cut down wholesale for the purpose, and this has gone on to such an extent that the Board of Agriculture has grown alarmed at the prospect, and has been considering whether they should not give a bonus to landowners to induce them to replant any area which has been cleared, so as to ensure that the very limited acreage of woodlands in Great Britain should not be further reduced. These things point to the fact that the forestry question must come to the front almost immediately. As soon as the war is over, the Government will have, I think, to tackle the question, and they will tackle it far more energetically than they have done in the past. Meantime, it is for us and for all who are interested in forestry to be considering what steps should now be taken with that end in view. Perhaps there are some members in this room who would be prepared with suggestions this afternoon. We have a

resolution down on the Agenda paper which you have all seen, and which it is to be hoped may offer an opportunity if anybody has practical suggestions to make."

The Development of Afforestation.

The Secretary then read the Resolution, as follows:—

"The Royal Scottish Arboricultural Society in General Meeting assembled, while recognising that the first duty of the Nation at this time is to do everything in its power to bring the war to a speedy and successful termination, respectfully points out that at the end of the war a large number of soldiers who return may not be able to resume their former occupations and may desire to find outdoor employment and a comfortable home in the country, which, under present circumstances, they would not be able to do, and that Afforestation—with which might be advantageously combined Small Holdings and other Rural Industries—if carried out on a considerable scale in various centres, would afford suitable employment, under healthy conditions, for a large and ever-increasing rural population. The Society, therefore, without repeating the now familiar arguments in favour of Afforestation, all of which have been greatly strengthened by events since the war began, respectfully draws the attention of the Government to the urgent need of immediate preparation for the emergency referred to, and suggests that the Board of Agriculture for Scotland, as the body charged with the care of Forestry in this country, should be authorised to prepare schemes of Afforestation on the lines indicated, and should be assured that adequate funds will be provided to put those schemes into operation whenever the war is over, so as to meet the needs of returning soldiers and others who desire to settle upon the land."

The Chairman mentioned that letters had been received from the President and several members of the Society which, he thought, might be read.

Colonel Stirling, President of the Society, in a letter addressed to the Secretary, and dated 10th July, wrote as follows:—

"I hope that the General Meeting will adopt the resolution.

It is certainly the Society's duty to point out that, even in the period of retrenchment which must follow the huge expenditure on the war, the claims of afforestation as a necessary development of the country's resources will be as strong as ever.

"Had a State scheme of afforestation been in existence it would have been able to provide employment for a number of discharged soldiers, subject to careful selection of suitable men. Even now a well-planned scheme will be a good investment for the State; and though at the present moment it might be difficult to find sufficient labour, owing to the great number of men who have enlisted from the district most suitable for afforestation, after the war employment is likely to be scarce in the Highlands. The large rents, until recently, paid for deer forests and grouse shootings, and the considerable amount of employment depending upon them, will be reduced or disappear for a longer or shorter time. It cannot be expected that the demand for such luxuries will rise quickly to the old level after the end of this devastating war, and the consequent loss will be serious, not only on account of the reduction of local employment, which will hardly be felt during the war, but also on account of the disappearance of rateable values, which must already affect local authorities.

"In short, war conditions only emphasise the soundness of the Society's contention that afforestation is the chief means of improving the economic state of the Highlands."

The PRESIDENT then went on to say that although the Resolution as framed did not specifically ask for the formation of a separate department of the Board with a separate grant, that was still the devoted policy of the Society, as expressed in previous resolutions.

Mr GEORGE FRASER, Factor, Dalzell, wrote pointing out that it might not be possible to have Small Holdings in conjunction with every forestry scheme, that the difficulty of housing would be an important element in every scheme, and that housing as well as forestry ought to be fostered as a national question.

Mr JAMES KAY, Rothesay, wrote suggesting that Local Authorities might do more than they had done in the way of afforestation by forming plantations on the catchment areas of their water supplies.

Mr J. F. ANNAND, Adviser in Forestry, Newcastle-upon-Tyne, also wrote strongly supporting the resolution and pointing out

that the preparation of schemes of afforestation by a responsible authority in Scotland was a matter of urgency, and mentioning the excellent work that had been done by Liverpool Corporation and its officials at Lake Vyrnwy, where he said the Development Commissioners were making a splendid investment in the money they were putting into it, and expressing the opinion that schemes of a similar character could be repeated many times over throughout Scotland, and particularly in the west.

Mr Sydney J. Gammell, of Drumtochty, in moving the resolution, said :—"I hardly think it needs many words of mine or of any one else to commend a resolution like this to the Arboricultural Society at any rate, but we wish this resolution to go further, to have weight in the country and in the councils of the Government, and it is for that reason that we bring it up to day. The intention of the Council is that this resolution, if it is passed, as I trust it will be unanimously, will be forwarded to the responsible quarters, and we hope that some practical good may come out of it. We do not wish merely to meet and propose abstract resolutions dealing with this subject or any other. It has been the boast of this Society, and I think it is a true boast, and we may congratulate ourselves upon it, that we have been already instrumental in getting something done, at any rate, towards the development of forestry in this country, and it is our intention to press forward and get more and more done until forestry is taken in hand really thoroughly and practically by the Government of the country. Now we had some letters which the Secretary has read, and I do not think I need refer to them in detail. The resolution is before you, and what I think we should do is to pass it as it stands. Whether the work is by means of a separate department, which you will recollect it has always been the contention of this Society should be formed, or whether it is done in some other way, really does not matter, so long as the work is done, but I think if it is honestly and conscientiously taken in hand it carries with it the provision of, at any rate, a department of the Board of Agriculture with separate funds at its disposal to carry on that work, and that work alone. I say the effect of it being really seriously taken in hand carries that separation of departments almost with it. You cannot overload a department which at present exists and tack forestry on merely at the end. It is much too important a national issue to be subordinated to anything, and it certainly

deserves very much more recognition than it has had in the past from Government patronage, and also I may say from Government funds. But our main reason in bringing this resolution before the Society at this time is to see that immediate steps are taken for doing something. We do not depart in any way from the contentions which we have always made as to the means which should be taken for the development of forestry in this country, but we feel sure that it is necessary, if good is to come out of it when peace is signed, that schemes which are undertaken then will be such as will commend themselves to the country, and be productive of practical good. Unless those schemes are well thought out beforehand, they will not be successful. It is the immediate preparation of the schemes which is so absolutely essential in the circumstances in which we find ourselves. We do not ask for large purchases of land, or for any large expenditure just now. We have a feeling, I am sure, that all our available resources should be used for prosecuting this war to a successful conclusion, but there is already in existence the nucleus of a staff, the nucleus, I might almost say, of a department, which is capable of considering these schemes, and it is those people who should be empowered to undertake that consideration now, and should be provided now with sufficient funds, which would necessarily be very small, to carry out their investigations, and to put things in proper form for the expenditure of larger amounts in the future. I think that that should be made clear, and I am quite confident that in urging this resolution to-day, and in urging it, when passed, upon the Government, we are doing a good work not only for forestry, which we look upon as an essential part of our national progress in the future, but we are doing a good turn for our country, and for some of those who have been fighting for us across the seas and who may want our help when they come back. I have great pleasure in formally moving the adoption of the resolution."

Mr W. M. Price, Factor, Minto, seconded.

Mr E. G. Baxter of Teases suggested that the words "and sailors" be added to the resolution, which was agreed to.

The Chairman invited suggestions before putting the resolution to the meeting.

Professor Somerville, of the Chair of Rural Economy, Oxford University, said:—"I am very glad to have an opportunity of appearing at a meeting. Whether I may have come with any

views that are of value is a different matter, but I think there is little doubt that the subject in which we are all interested does afford an opportunity for the profitable utilisation of the services of those brave men for whom nothing that we can do can be anything like equal to the occasion. Many of them, of course, as we know, have gone from occupations of this sort, and in coming back to the planting and tending of trees they will be returning to familiar and congenial work. I should hope that we should also be able to attract others who have not been so fortunately situated with regard to country work, and those whose lot has been thrown in industrial centres might find in the country an opportunity of utilising their labour. I see that you are still dissatisfied with what the authorities are doing for you. I read, too, a note of regret, I think, into the resolution, a note of lack of contentment with the progress that has been made. I do not know whether I also detected a note of envy in the idea that other countries have gone any further than Scotland has. I think Mr Annand, in his letter, seemed to indicate that more had been done south of the Border than north of it, but perhaps some of us who know southern conditions better would hardly be prepared to say that any more progress has been made as regards the development of afforestation even there. In any case, there is no doubt that Scotland is pre-eminently the country where national afforestation ought to catch on, and it is clearly the country of all others where conditions of success are most manifestly present. We have had a Government Committee sitting in England which is charged with finding areas. I have an idea that you have had such a task imposed upon you in the past. It is one thing, however, for a Government Department to say 'Go and find'; it is another thing for the Government Department, when you have reported, to accept your recommendation. We are in the condition in the south at present, so far as I understand the situation, of searching for areas, but I am bound to say that my experience of the past does not make me very sanguine of great results emerging from this search. Whether the conditions after this terrible cataclysm is past will be good for afforestation or not, is very difficult to say. On the face of it, one would, of course, expect that the country would put its house in order, and develop to the utmost of its natural and national opportunities; but with much more money at its disposal the same claims have been urged in the

past when conditions were quite as favourable, and small progress was made."

Mr G. F. Barbour of Bonskeid asked if the Council had any special plan or method in view of bringing this resolution prominently to the attention of one or two Ministers, and of as many of the Scottish Members of Parliament as are still attending to political duties. It seemed to him that this was a time at which it might be possible, now that political considerations of the ordinary kind were largely laid on one side, for the Society arranging for prominent influential constituents in different parts of Scotland to write to their members on this subject. A circular arriving with a covering letter from a society was apt to go right into the waste-paper basket.

The Chairman said that nothing of that particular kind has been done, but that the intention of the Council was that this resolution should be sent, not only to Ministers, but to all Members for Scotland, asking their special attention to it. The Council also intended to follow the matter up if they did not find progress had been made.

Mr J. H. Dods, Factor, Novar, said:—"Is it intended that the Society should hint in any way as to what they think should be done in the way of preparing a scheme? This resolution is rather general, and does not give any guidance, though perhaps the Board of Agriculture would not desire an offer of guidance; but it appears to me there is one point which should be considered in that light since this pit-wood question has cropped up, and that is, that land on which the trees have been felled should be re-planted, and that proprietors who have been felling should be encouraged to re-plant by some arrangement of Government loan, if possible. I know that the question was discussed before, but not in the light of the enormous want of pit-wood which is being felt, and if the Government could lend money for drainage to bury 1½-inch pipes in deep clayey land, they could advance money for putting good young trees on the surface of the ground where they are always in evidence, and where security is ever increasing in value. I should like the Society to draw attention in some way to the necessity for borrowing powers from Parliament."

The Chairman said:—"I think the Board of Agriculture is in no doubt whatever as to what this Society desires. Suggestions have been made many times to them, and they know what our

recommendations would be. This resolution proposes that they should be authorised to prepare schemes and should be assured of adequate funds. Until they are authorised to prepare schemes, perhaps it would be a little premature to go to them with a ready-made scheme."

Sir JOHN STIRLING-MAXWELL said :—" I should like to say one word on the point Mr Dods raised about pit-wood. Of course, the real opportunity for dealing with that was at the beginning of the war, when a heavy demand was made for pit-wood, and when the Government did make an arrangement under which it might be brought at a cheaper rate for long distances. That opportunity was missed, as all opportunities of that kind have been missed, and unless we can get some change in those who govern us, always will be missed, because there is nothing ready when the emergency arises. If we had a properly equipped Department of Forestry who had considered our future, there would have been machinery to meet that emergency. There was nothing of the kind. I know about what happened, because with other members of the Society I had to attend meetings of the Committee at the Board of Agriculture considering the matter. But the pit-wood was wanted in a hurry, and something had to be done, and no conditions as to re-planting were ever considered at all. I think that that particular matter might well be brought to the recollection of the Government by the Society when urging the point with which this resolution is concerned. In this resolution, we are trying to guard against a situation at the end of the war, when we might suddenly be told that there are five hundred or five thousand, whatever number it might be, men waiting at Southampton or somewhere who are to be employed in forestry, and the thing had to be arranged in a fortnight. That would mean a huge waste of money, and a scheme would result which in all probability would be a failure. What we want the Government to do is to act while it has got time, and while it has got in Scotland—to a considerable extent, since its advisers have been appointed—a staff. We want them to spend their time now in finding a place where schemes of afforestation could be carried out, where land could be got at a reasonable rate, either by purchase or by lease, and that they should take some preliminary steps such as securing that plants would be available, and making arrangements for housing men, perhaps on the lines Mr Dods suggested

just now. They should consider those places from the point of view of their ultimate value as forestry centres; and should have schemes ready in case they are wanted. Whether they will be wanted or not we cannot say. It is possible there will be anything but a shortage of labour after the war. In that case, the preparations would be in vain. If it is the other way, and the Government turns its gaze in haste and anxiety towards forestry as a source of employment, we know that the result can only be disastrous unless proper preparation has been made in due time."

The CHAIRMAN said :—"I have been asked whether the Board of Agriculture could do anything to assist landowners in re-planting areas which have been cleared. There has been a conference on the subject with the Board of Agriculture, but after various suggestions had been discussed, and after a little interval for consideration, a letter has been received from the Board of Agriculture saying that there are no funds available, and that they do not see their way to do anything further in the matter."

The resolution was carried unanimously, with the addition suggested by Mr Baxter.

It was agreed to send copies of the resolution to the Prime Minister, the Chancellor of the Exchequer, the Secretary for War, the First Lord of the Admiralty, the Secretary for Scotland, the President of the Local Government Board, the President of the Board of Trade, the Treasury, the Board of Agriculture for Scotland and the Development Commissioners, and to each Scottish Member of Parliament.

A vote of thanks to the Chairman for presiding was moved by Mr W. H. MASSIE, Edinburgh, and cordially adopted.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1916.

THE ANNUAL MEETING.

The Sixty-third Annual Business Meeting of the Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Saturday, 5th February 1916, at 12.45 P.M., and was attended by about forty members. In the unavoidable absence of Colonel STIRLING of Keir, President of the Society, on military duty, Sir ANDREW AGNEW, Bart. of Lochnaw, senior Vice-President, was called to the Chair. Mr JOHN D. SUTHERLAND represented the Board of Agriculture for Scotland at the meeting.

APOLOGIES.

Apologies for absence were intimated from Mr Gammell of Countesswells, Professor Trail, Sir John Fleming, Captain Sprot of Riddell, Colonel Martin, Professor Stewart MacDougall, Messrs Boyd Watt, John M'Kerchar, G. P. Gordon, J. Boyd, Robert Forbes, and Mr and Mrs Wharton Duff.

MINUTES.

The CHAIRMAN said that unless the meeting wished that the Minutes of last meeting should be read, he would move that they be held as read and adopted.

Mr C. S. FRANCE, Aberdeen, moved that the Minutes be not approved. He said that the resolution altering Rule XIV. was not put to the meeting and carried in conformity with Rule XXI. after the amendment was defeated. The Chairman

pointed out to Mr France that it was the Minutes of the meeting held in July which were under consideration, the Minutes of the meeting held a year ago having been approved at the July meeting.

The Minutes of the July meeting were thereafter approved.

Report by the Council.

The Secretary then read the Council's Report as follows:—

The Society's Roll of Honour, which was published in the *Transactions* in July last, included the names of 121 members of the Society who were serving with the colours either at home or abroad, and a further list containing 60 additional names appears in the January *Transactions*, making the total ascertained to date 181. Unfortunately the following fatal casualties have been reported since last Annual Meeting:—The Hon. Godfrey Macdonald; Corporal Donald Grant; Captain Thomas Alison; Colonel Alex. Fraser; Captain Sir John Fowler; Lieut. C. W. Burnley Campbell; Lieut. Angus Urquhart, and Lieut.-Colonel Lord Ninian Crichton Stuart.

In addition to these war casualties the following deaths have been recorded:—Mr W. Storie, Whitway House, Newbury; Mr David W. Thomson, Nurseryman, Edinburgh; Mr James Low, Forester, Ballindalloch; Mr William Ironside, Solicitor, Oban; Mr John T. Watson, Solicitor, Edinburgh, Auditor to the Society; Mr E. H. Robertson of Burnside, Forfar; Sir Michael B. Nairn of Rankeillor; Bailie Alston, Glasgow; Mr Donald R. Macdonald, Assistant Forester, Almondbank; Mr Alex. Mackinnon, The Gardens, Scone Palace. Other names have been removed from the Roll in the usual way owing to resignation and lapsing, and the total membership is now 1376 being 56 less than last year.

The Council.

Since the last Annual Meeting there has been two changes in the personnel of the Council. Mr Gillanders resigned on his removal to Maiden Bradley and was succeeded by Mr James Grant, Forester, Raith, and Mr David W. Thomson, who died in March last, was succeeded by Mr Thomas Bryden, Nurseryman, Ayr.

The Transactions.

The *Transactions* are in course of being issued, and while members will notice that the matter is less in quantity they will find that it is of the usual high quality.

The Excursion, the Forestry Exhibition and the Nursery and Plantation Competitions.

These have all been postponed owing to the war.

Essays.

Two essays only were received last year. One of these was awarded a No. 1 Silver Medal, and the other a Bronze Medal. Members are reminded that they may write on any subject connected with forestry, but that a list of suggested subjects may be obtained from the Secretary.

Prizes.

Last year Mr John H. Alexander, Nurseryman, Edinburgh, was good enough to intimate his willingness to give a prize of £5 for any subject in connection with the Annual Forestry Exhibition which the Council might agree on. Unfortunately, last year's exhibition had to be abandoned, but Mr Alexander has expressed his willingness to renew his offer when the war is over and the normal work of the Society is resumed.

The Trustees.

Owing to the resignation of the Right Hon. Sir Ronald Munro Ferguson, now Governor-General of Australia, as one of the Trustees of the Society, it is necessary to appoint a successor, and the Council recommend that Sir Andrew Agnew of Lochnaw be elected.

The Auditor.

A new Auditor is also required owing to the lamented death of Mr John T. Watson, which took place on 28th June last. Mr Watson held the appointment of Auditor to the Society for twenty years, and during that long period he discharged the duties of the office with great efficiency and acceptance. The Council asked Mr Alexander J. Munro to carry through the audit of last year's accounts, and they now recommend that he be formally elected Auditor.

Employment in Forestry for Women and Disabled Soldiers.

Owing to the scarcity of men to carry on forestry work, the Council decided to try the experiment of employing women who had been deprived of their ordinary occupations by the war.

A Committee of the Council accordingly arranged to communicate with the Scottish Committee on Women's Employment in the matter, with the result that a large number of women had been placed in various parts of the country. The engagements were temporary, but there is reason to believe that many of the experiments had been successful and would very probably be continued. The War Office and Labour Exchanges were also communicated with regarding the employment of soldiers discharged as unfit for further service with the colours. A memo. on the subject of forestry and other work which might be undertaken by women and partially disabled men was published in the July *Transactions*.

Development of Afforestation.

At the General Meeting of the Society, held on 14th July last, the following Resolution was unanimously adopted :—

> "The Royal Scottish Arboricultural Society in General Meeting assembled, while recognising that the first duty of the Nation at this time is to do everything in its power to bring the war to a speedy and successful termination, respectfully points out that at the end of the war a large number of soldiers and sailors who return may not be able to resume their former occupations and may desire to find outdoor employment and a comfortable home in the country, which, under present circumstances, they would not be able to do, and that Afforestation—with which might be advantageously combined Small Holdings and other Rural Industries—if carried out on a considerable scale in various centres, would afford suitable employment, under healthy conditions, for a large and ever-increasing rural population. The Society, therefore, without repeating the now familiar arguments in favour of Afforestation, all of which have been greatly strengthened by events since the war began, respectfully draws the attention of the Government to the urgent need of immediate preparation for the emergency referred to, and suggests that the Board of Agriculture for Scotland, as the body charged with the care of Forestry in this country, should be authorised to prepare schemes of Afforestation on the lines indicated, and should be assured that adequate funds will be provided to put those schemes into operation whenever the war is over, so as to meet the needs of returning soldiers and sailors and others who desire to settle upon the land."

In submitting the resolution to the meeting on behalf of the Council, it was made clear that the Society did not depart in any way from the contentions which it had always made as to the

means which should be taken for the development of forestry in this country which had already been made known to the Government by previous resolutions and conferences.

The resolution was sent to His Majesty's Ministers and all Members of Parliament for Scottish constituencies, and many of the latter expressed hearty approval of its terms. The Secretary for Scotland subsequently explained that the resolution was under consideration by the Boards of Agriculture for England and Scotland and the Development Commissioners. A further request for a report of progress in view of this meeting was lately addressed to the same Minister, and a reply has now been received to the effect that the question of the employment of returned soldiers and sailors is engaging the attention of the Government, and that the Board of Agriculture for Scotland has considered the question which the Society raises in its various aspects, but at present no actual scheme has been put before the Secretary for Scotland which would provide for any substantial number of returned soldiers and sailors on a scale of expenditure which, in the present state of national finances, is likely to be sanctioned by the Treasury.

The fifth Annual Report of the Development Commissioners has now been issued, but, as it deals with the year to 31st March 1915 only, the matter referred to above is not dealt with in it. On the subject of a Forestry Demonstration Area for Scotland, however, the Committee regret that up to the present (31st March 1915) their proposals for the establishment of such an area have not been accepted and that the matter remains in abeyance. With regard to the afforestation of privately owned land, the Commissioners say that they cannot legally make advances to individual landowners, but that, after consultation with the Board of Agriculture, they have adjusted the general principles upon which they are prepared to recommend advances to the Board for the afforestation of suitable land leased from private owners.

Since the date of last report a committee of the Council has had an opportunity of inspecting the area which the District Committee of the Upper Ward of Lanarkshire have undertaken to afforest in connection with their new water supply at Camps in Lanarkshire. The deputation visited first the nurseries and buildings at Hairmyres, on the border of the industrial part of Lanarkshire where consumptives are to be trained to country work, having previously been employed in industrial work. They afterwards proceeded to Camps, forty miles farther south, where the forest, an area of about 3000 acres, is to be planted round the reservoirs which are to supply the district with water. The site selected for this forest appeared to the deputation to be extremely promising; the soil was excellent and the ground required little draining. The District Committee had further shown their good sense in recognising that expert advice was

necessary in dealing with an undertaking of this kind. They also proposed to employ and train as foresters a number of disabled soldiers in connection with their afforestation scheme at Camps, and at their request the Council had agreed to co-operate with them in finding employment for such men as they may be able to train.

Dunn Memorial Fund.

There have been no payments in the course of the year.

Library.

The usual list of presentations to the Library is appended.

Local Branches.

The report and accounts of the Aberdeen branch are appended to this report as usual. Owing to the absence of the Hon. Secretary of the Northern branch on active service, and his subsequent death at Neuve Chapelle, no progress was made with the affairs of that branch during the year.

Royal Scottish Museum.

With reference to the negotiations dealt with in last report regarding the housing of the Economic Botany Section, which included the forestry specimens belonging to the Society in the Museum, the following correspondence has passed between the Secretary and Mr Stebbing, Lecturer in Forestry in the University:—

"19 Castle Street, Edinburgh,
"16*th June* 1915.

"Dear Mr Stebbing,

"The Director of the Royal Scottish Museum some time ago indicated to my Council that, owing to want of space in that Museum, he might find it necessary to transfer to your new forestry Museum in the University some forestry specimens which formerly belonged to this Society, and which have hitherto been included in his Economic Botany Section.

"My Council will be glad to concur in the transference from the Royal Scottish Museum to your Museum of the specimens referred to, provided they are assured that members of the Society and all others interested will be given reasonable facilities for visiting your Museum and inspecting your collections. No doubt you can give my Council the assurance they desire, and I shall be glad to hear from you on the subject.—I am, yours faithfully,

"R. Galloway,
"*Secretary.*

"Lecturer in Forestry,
"University."

"University of Edinburgh,
"Department of Forestry,
"*24th June* 1915.

"Dear Mr Galloway,

"In reply to your letter of 16th June 1915, I write to say that we shall be always delighted to see members of the Royal Scottish Arboricultural Society visiting our Museum, and all reasonable facilities will be afforded both to members of the Society and others interested in forestry.—Yours faithfully,

"E. P. Stebbing,
"Head of Department of Forestry,
"University of Edinburgh.

"The Secretary,
"Royal Scottish Arboricultural Society."

The Government of Canada had an interesting exhibit of Canadian timbers in Glasgow during the summer, which they kindly offered to duplicate as a permanent collection for Edinburgh if the Society could arrange suitable accommodation for it. The space required was about 20 square yards. In the circumstances the Council thought that such an exhibit, being of the nature of a national collection, ought to be housed in the Royal Scottish Museum, but on application being made to the Director, he replied that as there was no space available for the adequate display of the present possessions of the Museum, the provision of 20 square yards for the accommodation of new material was quite impossible.

Conference with the Board of Agriculture on the subject of replanting Cleared Areas.

In March last a committee of the Council had a meeting with the Board on the subject of the encouragement that might be given by the Government to owners of land to replant areas then being cleared of immature timber for providing collieries with pit-props. The matter was fully discussed, and it was agreed to recommend to the Board that proprietors who replanted such areas or equivalent areas should receive a bonus of a sum per acre planted equal to about half the cost of the plants used. A letter was, however, subsequently received pointing out that the Board was unable in present circumstances to ask the Treasury to sanction the payment out of the Development Fund or the Agriculture (Scotland) Fund of grants for this purpose.

The demand for timber for Government purposes having now vastly increased, with the result that extensive areas are being cleared and arrangements are being developed to still further increase the home supplies which may end in the complete clearance of a large proportion of the woodland areas of the

country, the Council have again directed their attention to the problem of restocking these areas. They recognise (1) that the replanting of all the cleared areas is a matter of great national importance, and (2) that as it was improbable that all these areas would be replanted by the owners voluntarily, some sort of Government action would be necessary to insure that the work is done within a reasonable time.

Forestry and Income Tax.

The Finance (No. 2) Act, 1915, provides that, in future, occupiers of woodlands shall pay Income Tax under Schedule B on the full rental as appearing in the Valuation Roll in place of on one-third of that rental as formerly. It also provides that any occupier, who proves to the satisfaction of the General Commissioners that his woodlands are managed on a commercial basis with a view to the realisation of profits, may elect to be charged under Schedule D instead of under Schedule B, subject as follows:—

(*a*) Any such election shall extend to all woodlands so managed on the same estate; and

(*b*) The election shall have effect not only as regards the year of assessment mentioned in that section (18 of the Customs and Inland Revenue Act 1887), but also as respects all future years of assessment so long as the woodlands are occupied by the person making the election.

Section 18 referred to is the section giving the option to farmers to be charged under Schedule D, and providing for notice either to be delivered personally or by registered letter to the Surveyor of Taxes within two calendar months after the commencement of the year of assessment and after receipt of the notice, the charge upon the farmer to the duties of Income Tax for such year shall be under Schedule D, and his profits or gains shall be considered to be profits or gains of a trade chargeable under that Schedule.

The difference between the farmer and the arboriculturist in making this election is that the farmer's election stands for one year only, whereas the arboriculturist having once made the election must stand by it as long as he occupies the woodlands.

A draft form of accounts prepared by the Inland Revenue was sent to the Society for consideration, and on returning the form approved the following recommendations were submitted for consideration by the Inland Revenue:—

(1) That in the event of assessment under Schedule D being chosen for woodlands, an average of at least five years' accounts should be taken, and that if accounts could be shown for ten years, that period would be preferable.

(2) That the term "woodlands managed on a commercial basis" should be interpreted as meaning all woodlands, including shelter-belts and strips which do not form part of pleasure grounds or gardens, and which are not managed exclusively for game preserves. There would appear to be no reason why certain woods in policy grounds should not be managed for commercial purposes.

(3) That the assessment under Schedules B or D in respect of woodlands should be considered as "earned income" in the same way as similar assessments in the cases of agricultural subjects. This would be of benefit to small estates, and would be no more than reasonable.

(4) That so far as any of these matters cannot be determined by regulations issued by the Inland Revenue, the necessary alterations should be made in the next Finance Bill.

A reply has now been received from the Chief Inspector of Taxes, Somerset House, W.C., as follows:—

"The income from woodlands managed on a commercial basis would normally be regarded as 'earned' income, whether assessed under Schedule B or under Schedule D, and would be entitled to reduced rates of tax where the occupier's total income does not exceed £2500.

"I will forward the remaining suggestions that your Committee have been good enough to make to the Board of Inland Revenue for consideration, as they appear to be matters that could be dealt with effectively only by means of legislation."

Excess Profits Duty.

On this subject the Secretary of the Board of Agriculture and Fisheries, London, under date 28th January 1916, writes as follows:—

"Sir,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that he has been in communication with the Chancellor of the Exchequer on the subject of Excess Profits Duty on timber, and that Mr M'Kenna has authorised him to state that even if the provisions of the Finance Act (No. 2), 1915, which deal with Excess Profits Duty apply to the profits derived by landowners from the sale of their timber, it is agreed that in the case of 'commercial' woodlands assessed to Income Tax under Schedule B the profits for the purpose of Excess Profits Duty shall be taken to be the amount assessable under that Schedule.

"In the case of woodlands which are not run on 'commercial' lines, there would be no trade or business and the question of Excess Profits Duty would therefore not arise.

"The effect is that landowners who at the present time are willing to meet the national demand for timber by largely increasing their felling and sale of timber, can continue to be assessed for income tax under Schedule B on an annual value and run no practical risk of liability for Excess Profits Duty."

Home Forest Industries.

The Council has appointed a Committee to consider what steps might be taken by the Society to encourage and foster Home forest industries, such as Trade Nurseries, Home Nurseries, and Home Timber concerns, and would welcome suggestions from members on this subject.

Home-Grown Timber Committee.

The Government has appointed a Committee—

> "To purchase and convert standing timber, to supply such timber to Government Departments, and generally to make arrangements for further utilisation of native timber resources."

The Society is represented on the Committee by the Hon. Secretary, Sir John Stirling-Maxwell, Bart.

A small Consultative Committee for Scotland has also been appointed to advise the Executive Committee, and the Society's representative on this Committee is Mr Galloway, who has also been asked to act as Secretary.

Members having timber—either standing or manufactured—for sale are recommended to communicate with the Home-Grown Timber Committee, 29 St Andrew Square, Edinburgh.

On the motion of the CHAIRMAN, the Council's report was unanimously adopted.

(The Chairman's speech, and the discussion which followed upon it, are printed on p. 69 of the *Transactions*.)

FINANCES.

The Abstract of Accounts for the year ending 31st December 1915, which had been printed and circulated amongst the members, and also the accounts in connection with the Dunn Memorial Fund, both of which had been duly audited, were formally submitted for adoption.

Mr W. H. MASSIE, in moving the adoption of the accounts, said: "We have suffered a little from the war. This year especially Life Subscriptions have dropped very largely. In 1914 they were £180; this year they are only £25. Of

course you must remember that a special effort was made to secure Life Members in 1914, and we do not look on this with any sort of despondency, but we are quite sure that, when once things are normal again, we shall flourish in this way more than ever. The annual subscriptions have dropped by about £12. Our expenses are very much down from last year, but 1914 was not a normal year. We had the great gathering of that year, you will remember, which involved a lot of expense. The cost of the *Transactions* is considerable, but I am sure you will all agree that this is money well spent. They are carrying more weight every year. For over fifty years they have been preaching the gospel of afforestation in this country, and the present state of affairs shows how right their advice was and how good it would have been for us if it had been followed much more than it was."

Mr James Whitton, Glasgow, seconded.

On the suggestion of Sir John Dewar, Bart., it was agreed to write down the stocks to market value as in former years. The accounts were then adopted.

Reports from Aberdeen Branch.

The Secretary then read the reports from the Aberdeen branch which, on the motion of the Chairman, were adopted.

Election of Office-Bearers.

The Chairman.—I would now ask you to proceed with the election of office-bearers for 1916.

Mr France entered his protest against any office-bearers being elected under a rule which, he said, had not been passed constitutionally.

Mr J. W. M'Hattie, Edinburgh, proposed that Sir Andrew Agnew, Bart. of Lochnaw, be elected President of the Society, and this was unanimously agreed to.

On the motion of Mr Whitton, Glasgow, the following were elected members of the Council in room of those who retired :— Colonel Stirling of Keir, J. A. Duthie, Aberdeen, A. MacCallum Scott, M.P., W. S. Curr, Ninewar, Charles Robertson, Colstoun, Sir John A. Dewar, Bart. of Dupplin, Alexander Morgan, Crieff, George Mowat, Hamilton Estates, and Peter Leslie, B.Sc., Aberdeen.

The Honorary Secretary, the Honorary Editor, the Secretary and Treasurer, the Honorary Consulting Scientists, and the Local Secretaries were re-elected. Mr Alexander J. Munro was elected Auditor in room of the late Mr John T. Watson, and Sir Andrew Agnew, Bart., was elected a Trustee in place of the Right Hon. Sir Ronald Munro Ferguson, at present resident in Australia as Governor-General of the Commonwealth.

The Excursion.

Mr Charles Buchanan, Convener of the Excursion Committee, said that owing to the continuance of the war the Committee had agreed to delay making any arrangements this season.

Forestry Exhibition.
Nursery and Plantation Competitions.

Mr Robert Allan, Convener of this Committee, said that for the same reason his Committee also decided some time ago that it would be advisable to abandon the usual Exhibition and these Competitions.

Votes of Thanks.

Mr J. H. Milne Home.—"I beg to move a very special vote of thanks to our late President, Colonel Stirling, for his services to this Society during the past three years. I expect that every one who has attended the annual excursions or the annual meetings, and more especially members of Council, will be aware of the very large amount of work which Colonel Stirling has done for this Society during three somewhat important years of its existence. Especially I think we are indebted to him for the work he did during the time of the Diamond Jubilee Excursion and the meetings of that year. It was not only the more formal and necessary duties as President, but the way in which he threw himself into the working of that excursion and the very important part which he took in entertaining the foreign guests on that occasion. For his services in that connection, and in connection with the whole work of the Society during the past three years, I am sure we owe him a deep debt of gratitude. It has been unfortunate for this Society that he has been unable to be present at the meetings and to attend to its work during the past year, but I think we all recognise that he has been

doing work which, from a national point of view, is even more important than that, and he has done it with great credit to himself, to this Society, and I think I may say, to Scotland as well."

The CHAIRMAN.—"I am sure we unanimously agree, and we must take an opportunity of communicating the resolution to Colonel Stirling. I think it would probably be a pleasure to him to know that on this occasion his work has been referred to in such an appreciative manner."

Mr A. D. RICHARDSON moved a vote of thanks to the retiring members of Council.

Mr ANNAND, Armstrong College, said:—"I beg to move a vote of thanks to Sir Andrew Agnew for his most interesting, concise and practical common-sense address on the forestry question. Sir Andrew's address just occupied, according to the clock, seven minutes, but in that time I think he said more and said it better than many another man would have said it in two hours."

The CHAIRMAN.—"I am in danger of going away with too much flattery, but I am very grateful to Mr Annand for having proposed this vote of thanks, and I beg to thank you for the way in which you have endorsed what he has said. I think we have had a very interesting meeting."

APPENDIX A.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, YEAR 1915.

RECEIPTS.

Balance in Bank at close of last Account . .	£0	12	11
Income Tax recovered	0	3	10
Dividend on £100 Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1915, £3, *less* Tax, 9s. .	2	11	0
	£3	7	9

PAYMENTS.

Nil

Balance carried forward, being sum in National Bank of Scotland on Account Current .	£3	7	9

Note.—The Capital belonging to the Trust consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 24*th January* 1916.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

ALEX. J. MUNRO,
Int. Auditor.

APPENDIX B.

Abstract of Accounts for Year ending 31st December 1915.

I.—CAPITAL.

CHARGE.			DISCHARGE.			
			Secretary's Bond of Caution, . .		4 13 7	
			Councillors' Luncheons . . .		8 6 0	
			Postages and Miscellaneous Outlays, viz.:			
			Postages of Parts I. and II. of Vol. XXIX. of *Transactions*,	£33 8 8		
			General Postages, Commissions on Cheques, and Petty Outlays, . .	23 14 11		
					57 3 7	
					£257 19 2	
			8. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*, . . .			308 11 2
			Note.—Balance of Revenue as above, . .		£308 11 2	
			Less Balance at debit of Capital as above,		120 15 7	
					£187 15 7	
			Consisting of—			
			Sum at credit of National Bank of Scotland, Ltd., .	£187 3 7		
			Sum in Treasurer's hands, .	0 12 0		
					£187 15 7	
		£802 18 10				£802 18 10

Edinburgh, *24th January* 1916.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1915, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Interim Auditor.*

APPENDIX B.

Abstract of Accounts for Year ending 31st December 1915.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1914,		£1694 8 9
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 94⅝,	£472 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 100⅔,	501 17 6	
£400 North British Railway Company 3 per cent. Debenture Stock, at 74⅜,	297 10 0	
£400 North British Railway Company, No. 1, 4 per cent. Preference Stock, at 97,	388 0 0	
	£1659 17 6	
Furniture, etc., in Society's Room,	40 0 0	
	£1699 17 6	
Less Balance at Debit of Capital,	5 8 9	
	£1694 8 9	
2. Life Members' Subscriptions in 1915,	£15 15 0	25 11 0
New Members,	9 16 0	
Ordinary Members by commutation,		
		£1719 19 9

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£140 17 10
Unexhausted: £583 17 10	⅕ of Full Life Subscriptions, £118 7 2	
115 4 5	⅕ of Commuted Subscriptions, 22 10 8	
2. Funds, etc., at 31st December 1915, as valued at close of 1913—		
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 94⅝,	£472 10 0	
£500 Caledonian Railway Company 4 per cent Debenture Stock, at 100⅔,	501 17 6	
£400 North British Railway Company 3 per cent. Debenture Stock, at 74⅜,	297 10 0	
£400 North British Railway Company, No. 1, 4% Preference Stock, at 97,	388 0 0	
	£1659 17 6	
Furniture, etc , in Society's Room, say,	40 0 0	
	£1699 17 6	
Less Balance at Debit of Capital,	120 15 7	
		1579 1 11
		£1719 19 9

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1914,		£199 18 8
2. Ordinary Members' Subscriptions,		383 16 6
Arrears at 31st December 1914,	£40 4 0	
Subscriptions for 1915, £407 2 6		
Less Received in 1914, 3 18 6		
	403 4 0	
Subscriptions for 1916 received in 1915,	8 0 0	
	£451 8 0	
Deduct—		
Cancelled or written off as irrecoverable at 31st December 1915, £20 9 0		
Arrears at 31st December 1915, 47 2 6		
	67 11 6	
	£383 16 6	
3. Proportion of Life Members' Subscriptions transferred from Capital,		140 17 10
4. Dividends and Interest,		66 14 3
5. *Transactions* and Reports sold,		7 9 3
6. Income Tax Recovered,		4 2 4
	£802 18 10	

DISCHARGE.

1. Printing, Stationery, etc.,		£269 4 0
Vol. XXIX. Part I. *Trans.*, £109 1 6		
Authors' Reprints, 3 3 9		
	£112 5 3	
Vol. XXIX. Part II. of *Trans.* £93 8 0		
Authors' Reprints, 2 17 6		
	96 5 6	
	£208 10 9	
General Printing and Stationery, £30 5 3		
Forestry Periodicals, Binding, etc., 3 11 6		
	33 16 9	
	£242 7 6	
Less Receipts for Advts. in *Trans.*,	33 3 6	
	£209 4 0	
2. Prizes (Money, 10s.; Medal, £1, 4s.)		£1 14 0
3. Forestry Exhibition—		
Extra tabling racks, etc., 1914, at Hawick	£2 18 0	
Printing Schedules, etc , 1915	7 1 0	
		9 19 0
4. Nursery and Plantation Competition in Show District—		
Printing Schedules		5 1 6
5. Contribution to Aberdeen Branch,		5 0 0
6. Fee to Reporter,		5 10 0
7. Expenses of Management,		257 19 2
Rent of Room and Taxes for 1915, and Hall for Annual and Summer Meetings,	£24 13 0	
Auditor,	3 3 0	
Hon. Editor's Assistant, £30; and Authors of French Notes for *Trans.*, £5,	35 0 0	
Secretary and Treasurer,	125 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	4 13 7	
Councillors' Luncheons	8 6 0	
Postages and Miscellaneous Outlays, viz.:		
Postages of Parts I. and II. of Vol. XXIX. of *Transactions*, £33 8 8		
General Postages, Commissions on Cheques, and Petty Outlays, 23 14 11		
	57 3 7	
	£257 19 2	
8. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,		308 11 2
Note.—Balance of Revenue as above,	£308 11 2	
Less Balance at debit of Capital as above,	120 15 7	
	£187 15 7	
Consisting of—		
Sum at credit of National Bank of Scotland, Ltd., £187 3 7		
Sum in Treasurer's hands, 0 12 0		
	£187 15 7	
		£802 18 10

EDINBURGH, 24th *January* 1916.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1915, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Interim Auditor.*

APPENDIX C.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1915.

The Committee beg to submit the Tenth Annual Report of the Branch.

The Membership of the Branch is 134, two having joined the Branch during the year.

Four quarterly meetings of the Branch were fixed to be held on 12th December 1914, 22nd May, 31st July, and 16th October 1915.

At the Annual General Meeting held in December formal business only was transacted, it having been previously decided that it was inexpedient to have an address delivered, as is usually done at the Annual Meetings of the Branch, on account of the continuance of the war, and for the same reason the meeting fixed for 16th October was reluctantly abandoned.

At the meeting held in May, Dr Trail, M.A., M.D., F.R.S., etc., Professor of Botany in the University of Aberdeen, the President of the Branch, gave his Presidential address, which took the form of a sketch of the various efforts which had been made from time to time by the University to embrace the subject of forestry in the University curriculum, as well as the gradual development of the study of arboriculture in the North of Scotland generally, and the address was of a most interesting and instructive character. At the same meeting, which was held in the Botanical Department of the University, the members had the privilege of visiting the new Forestry Department, in which three rooms have been provided as well as spacious out side accommodation, and the members were unanimous in thinking that the rooms would be a decided acquisition to the Department.

On the occasion of the meeting in July, the members of the Branch had the privilege, on the invitation of the Governors of the North of Scotland College of Agriculture, of visiting and inspecting the site of the proposed forest garden at Craibstone and the agricultural experiments there. In order to preserve a record of the inspection, it was remitted to Mr C. S. France, one of the Vice-Presidents, and Mr Peter Leslie, Lecturer in Forestry,

to prepare a detailed report of the proceedings, and a copy of same is appended hereto.[1]

After partaking of luncheon, which was served in Craibstone House, a short discussion, opened by Mr France and taken part in by several other members in a very spirited and interesting manner, on "The Naturalisation of Forest Trees," took place. Altogether the outing was one of the most pleasant and instructive in the annals of the Branch.

The Committee have again to record their thanks to Professor Trail and to the University authorities for the use of the Botany rooms for the meetings of the Branch.

JAMES W. H. TRAIL,
President.

GEORGE D. MASSIE,
Honorary Secretary.

ABERDEEN, *December* 1914.

[1] See *Transactions*, p. 130.

APPENDIX D.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1915.

GENERAL ACCOUNT.

INCOME.

	£	s	d
Balance at credit of last Account	10	2	5½
Subscriptions from Members at 1s.	3	18	0
Savings Bank Interest	0	5	5
Grant from Parent Society	5	0	0
	£19	5	10½

EXPENDITURE.

	£	s	d
Printing	1	2	6
Honorarium to Secretary for 1914	5	5	0
Postages and Incidental Outlay	2	0	0
Balance at Credit of Account	10	18	4½
	£19	5	10½

EXCURSION ACCOUNT.

	£	s	d
From Members for Excursion to Craibstone	4	4	0
Balance at Debit of Account	3	6	1
	£7	10	1

	£	s	d
Balance at Debit of last Account	0	10	6
Motors	2	2	6
Lunch	3	11	7
Printing, Posts, and Incidents	1	5	6
	£7	10	1

LIBRARY ACCOUNT.

	£	s	d
Balance at Credit of last Account	1	17	6
	£1	17	6

	£	s	d
Board of Agriculture for Scotland for leaflets	0	1	0
Postages and Incidents	0	5	0
Balance at Credit of Account	1	11	6
	£1	17	6

ABSTRACT.

	£	s	d
Balance at Credit of General Account	10	18	4½
Balance at Credit of Library Account	1	11	6
	12	9	10½
Balance at Debit of Excursion Account	3	6	1
Balance at Credit of Branch per Savings Bank Pass Book No. 393	£9	3	9½

Aberdeen, 18*th December* 1915.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and find the same properly stated and vouched, the balance at the credit of the Branch being Nine pounds three shillings and ninepence halfpenny, which sum is deposited with the Aberdeen Savings Bank, per Savings Bank Book, No. 393, which I have also seen.

Wm. WYLLIE.

APPENDIX E.

Office-Bearers for 1916 :—

PATRON.

His Majesty The King.

PRESIDENT.

Sir Andrew Agnew, Bart. of Lochnaw, 10 Smith Square, Westminster.

VICE-PRESIDENTS.

Lieut.-Col. W. Steuart Fothringham of Murthly, Perthshire.

Sydney J. Gammell of Countesswells, Countesswells House, Bieldside, Aberdeen.

John F. Annand, M.Sc., Adviser in Forestry, Armstrong College, Newcastle-upon-Tyne.

W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.

Chas. Buchanan, Factor, Penicuik Estate, Penicuik.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

Alexander J. Munro, Factor, 48 Castle Street, Edinburgh.

W. M. Price, Factor, Minto, Hawick.

Geo. Leven, Forester, Bowmont Forest, Roxburgh.

John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.

John Broom, Wood Merchant, Bathgate.

Alexander Murray, Forester, Kingswood, Murthly.

J. H. Milne Home, Irvine House, Canonbie.

Thomas Bryden, Dennison Nursery, Ayr.

John A. Howe, Land Steward, Chisholm Estate, Hawick.

G. P. Gordon, B.Sc., Advisory Forest Officer, West of Scotland Agricultural College, 204 Bath Street, Glasgow.

James Whitton, Superintendent of City Parks, City Chambers, Glasgow.

A. D. Richardson, 19 Joppa Road, Portobello.

Brig.-General Lord Lovat, K.T., D.S.O., Beaufort Castle, Beauly.

Frank Scott, Forester, Jeannie Bank, near Perth.

The Earl of Crawford and Balcarres, Balcarres, Fife.

James Grant, Forester, Raith, Kirkcaldy.

Brig.-Gen. Archibald Stirling of Keir, Dunblane.

J. A. Duthie, Nurseryman, Aberdeen.

A. MacCallum Scott, M.P., House of Commons, Westminster.

W. S. Curr, Factor, Ninewar.

Charles Robertson, Forester, Colstoun, Haddington.

Sir John A. Dewar, Bart. of Dupplin, Perth.

Alexander Morgan, Wood Merchant, Crieff.

George Mowat, Forester, Hamilton Estates, Riccarton by Hamilton.

Peter Leslie, B.Sc., Lecturer in Forestry, Marischal College, Aberdeen.

Extra Member—President of Aberdeen Branch (Professor Trail, 71 High Street, Old Aberdeen).

HON. EDITOR.

Dr A. W. Borthwick, 46 George Square, Edinburgh.

AUDITOR.

Alex. J. Munro, 48 Castle Street, Edinburgh.

HON. SECRETARY.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 19 Castle Street, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Professor Bayley Balfour, Royal Botanic Garden, Edinburgh.

Chemist—Dr Alexander Lauder, F.I.C., 13 George Square, Edinburgh.

Cryptogamist—Dr A. W. Borthwick, 46 George Square, Edinburgh.

Entomologist—Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh.

Geologist—Dr R. Campbell, Geological Laboratory, University of Edinburgh.

Meteorologist—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

Lieut.-Col. W. Steuart Fothringham of Murthly, Sir John Stirling-Maxwell, Bart. of Pollok, and Sir Andrew Agnew, Bart. of Lochnaw, Stranraer.

LOCAL BRANCHES.

Aberdeen.	Northern.
President.—Prof. Trail, Aberdeen University.	*President.*—
Hon. Secretary.—George D. Massie, Solicitor, 147 Union Street, Aberdeen.	*Hon. Secretary.*—

CORRESPONDENTS RESIDING ABROAD.

The following have agreed to act as Correspondents residing abroad :—

Canada, .	Robert Bell, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa, late Chief Geologist to Government of Canada, Ottawa.
India, . .	F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.
British East Africa, .	Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	Hugh P. Baker, Dean, New York State College of Forestry, Syracuse, N.Y.
Cape Colony, .	W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.
Western Australia,	Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.
New Zealand .	R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago.
South Africa .	K. A. Carlson, Orange Free State Conservancy.

PHOTOGRAPHIC ARTIST.

A. D. Richardson, 19 Joppa Road, Portobello.

LOCAL SECRETARIES.

Counties.	
	Scotland.
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyll,	H. L. MACDONALD of Dunach, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, retired Forester, Barone, Rothesay.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Factor, Dullomuir, Blairadam.
Lanark,	JOHN DAVIDSON, Forester, Dalzell, Motherwell.
	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray,	D. SCOTT, Forester, Darnaway Castle, Forres.
Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Ross,	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.
	England.
Beds,	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Derby,	S. MACBEAN, Estate Office, Needwood Forest, Sudbury.
Devon,	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham,	JOHN F. ANNAND, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire,	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester,	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.

Counties.	
	England.
Surrey, . .	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick, .	A. D. CHRISTIE, Hillside, Castle Road, Warley, Birmingham.
Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	GEORGE HANNAH, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture.
	ARCH. E. MOERAN, Lissadell, Stillorgan Park.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	ALEX. M'RAE, Forester, Dundrum.

APPENDIX F.

Presentations to the Library since the publication of the List in Volume XXIX. Part 2.

Books.

1. *Wood Pulp and its Uses.* By C. F. Cross, and others.
2. *Timber.* By J. R. Baterden, A.M.I.C.E.
3. *Chinese Forest Trees and Timber Supply.* By Norman Shaw, B.A.
4. *David Douglas' Journal*, 1823-1827. By the Royal Horticultural Society.
5. *Kew Bulletin*, 1914.
6. *Transactions of Highland and Agricultural Society*, 5 series, vol. 27.
7. *Journal of the Royal Agricultural Society of England*, vol. 75, 1914.
8. *Report of Smithsonian Institution*, 1913.
9. *Report of the Department of Forestry, Pennsylvania*, 1912-13.
10. *Insects and Man.* By C. A. Ealand, M.A., 1915.
11. *Forest Valuation.* By H. H. Chapman, M.F.
12. *The Artistic Anatomy of Trees: their Structure and Treatment in Painting.* By Rex Vicat Cole.

Government and State Reports.

13. Scotland :—*Third Report of the Board of Agriculture*, 1914.
14. England :—
    (1) *Report of the Commissioners of H.M. Woods, Forests, and Land Revenues*, 1915.
    (2) *Journal of the Board of Agriculture.*
15. Ireland :—*Journal of the Department of Agriculture and Technical Instruction for Ireland.*
16. Australia :—
    (1) *Report on State Forest Administration in South Australia*, 1913-14 and 1914-15.
    (2) *Report of the Director of Forests, Queensland*, 1914.
    (3) *Report of the Woods and Forests Department, Western Australia*, 1914.
17. Canada :—
    Forest Products, 1913 :—
    Lumber, Lath and Shingles. Bulletin No. 48.
    Treated Wood Block Paving. ,, No. 49.
    Wood-using Industries of the Prairie Provinces. No. 50.
    Timber Conditions in the Smoky River Valley and Grande Prairie Country. Bulletin No. 53.
    Pulpwood. ,, No. 54.
    Poles and Cross-Ties. ,, No. 55.
    Forest Fires. ,, No. 9.
    The Farmer's Plantation. ,, No. 10.
    Lumber, Square Timber, etc. ,, No. 11.
    Pulpwood. ,, No. 12.
    Report of the Director of Forestry, 1914 and 1915.

18. New Zealand :—*Report on State Nurseries and Plantations*, 1914-15.
19. India :—
    (1) *Quinquennial Review of Forest Administration in British India*, 1909-10 to 1913-14.
    (2) *Annual Report of the Forest Department of Madras Presidency*, 1913-14.
20. Indian Forest Bulletins :—
    (1) No. 27. *Note on Blackwood.* By E. Benskin, I.F.S.
    (2) No. 28. *Note on Dhauri.* By E. Benskin, I.F.S.
    (3) No. 29. *Note on Sundri Timber.* By R. S. Pearson, I.F.S., etc.
    (4) No. 30. | *The Compilation of Girth Increments from Sample Plot Measurements.* By R. S. Troup, F.C.H., etc.
21. Indian Forest Records :—
    (1) *Trametes Pini*, Fries, *in India.* By R. S. Hole, F.C.H., etc.
    (2) *A New Species of Forest Grass.* By R. S. Hole, F.C.H., etc.
22. Indian Forest Memoirs :—*The Structure and Biology of Tachardia lacca*, Kerr, *with Observations on certain Insects, Predaceous or Parasitic, upon it.* By A. D. Imms, D.Sc., and N. C. Chatterjee, B.Sc.
23. Federated Malay Estates :—*Report on Forest Administration*, 1914.
24. United States of America :—
    (1) Ohio State University Bulletins.
    (2) *Balsam Fir.* Bulletin No. 55 of Department of Agriculture. By Raphael Zon.
    (3) *Tests of Wood Preservatives.* No. 145 of Department of Agriculture. By H. F. Weiss and C. H. Teesdale.
    (4) *Bibliographical Contributions.* Lloyd Library, vol. ii., Nos. 4 and 5.
    (5) *Uses of Philippine Woods.* By Major George P. Ahern.
    (6) *Opportunities for Lumbering in the Philippine Forests.* By Major George P. Ahern.
    (7) *The Cypress and Juniper Trees of the Rocky Mountains.* Bulletin No. 207 of Board of Agriculture. By George B. Sudworth, Dendrologist.
    (8) *The Naval Stores Industry.* Bulletin No. 229 of Board of Agriculture. By A. W. Schrorger, Chemist, and H. S. Betts, Engineer.
    (9) *The Use Book, a Manual for Users of the National Forests*, 1915.
    (10) *Insects as Carriers of the Chestnut Blight Fungus.* By R. A. Studhalter and A. G. Ruggles. Issued by direction of the Commissioner of Forestry, Pennsylvania, 1915.
    (11) *Spruce and Balsam Fir Trees of the Rocky Mountain Region.* By G. B. Sudworth.
    (12) *Publications of the University of California.*
25. Switzerland :—*Annuaire Agricole de la Suisse*, 1851-1912.

Societies' and Institutions' Reports and Transactions.

26. Scotland :—
    (1) Royal Botanic Garden, Edinburgh :—*Notes for September* 1914, *January, March, April and May* 1915.
    (2) *Transactions of Botanical Society of Edinburgh*, vol. xxvi., part 4, 1914-15.
    (3) *Transactions and Proceedings of the Perthshire Society of Natural Science*, vol. vi., part 2, 1914-15.
27. England :—Association of Economic Biologists. *Annals of Applied Biology*, vol. ii., Nos. 1, 2, 3.
28. Ireland :—
    (1) *Scientific Proceedings of the Royal Dublin Society*, vol. xiv. (N.S.), Nos. 24-41.
    (2) *Economic* ,, ,, vol. ii., No. 10.
29. Canada :—*Proceedings and Transactions of the Nova Scotian Institute of Science*, vol. xiii., parts 3 and 4, and vol. xiv., part 1.

Reprints and Miscellaneous.

30. *The Relation of Forestry to the Development of the Country.* By R. H. Campbell, Director of Forestry, Canada.
31. *Report on Public Parks, Gardens and Open Spaces in Edinburgh*, 1914. By John W. M'Hattie, Supt. of Parks and Gardens.
32. *The Testing of Forest Seeds during Twenty-five Years*, 1887-1912. By Johannes Rafn, Copenhagen.
33. *The Athenæum Subject Index to Periodicals*, 1915. Science and Technology.
34. *Mededellingen Vom's Rijks Herbarium*, Leiden, Nos. 21-27, 1914-15.
35. *Bulletin of Economic and Social Intelligence of the International Institute of Agriculture, Rome, February* 1914.
36. *The Estate Magazine.*
37. *L'Alpe.* Firenze.
38. *Tidskrift for Skogsbrug.* Christiania.
39. *Skogsvårdsföreningens Tidskrift.* Stockholm.
40. *The Indian Forester.*
41. *Forestry Quarterly.* Washington, D.C.
42. *Quarterly Journal of Forestry.* London.
43. *Canadian Forestry Journal.*
44. *American Forestry.*
45. *Timber Trades Journal.*
46. *Timber News.*
47. *Revue des Eaux et Forêts.* Paris. (By purchase.)
48. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)
49. *Allgemeine Forst- und Jagd-Zeitung.* (By purchase.)
50. *Zeitschrift für Forst- und Jagdwesen.* (,,)

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